DOCUMENT RESUME

ED 268 345	CE 044 256
TITLE	Industrial Arts Education. Teacher Handbook. Vocational Education. Grades 9-12. North Carolina Competency-Based Curriculum.
INSTITUTION	North Carolina State Dept. of Public Instruction, Raleigh. Div. of Vocational Education.
PUB DATE	85
NOTE	339p.; For related documents, see CE 044 254-261.
PUB TYPE	Guides - Classroom Use - Guides (For Teachers) (052)
EDRS PRICE	MF01/PC14 Plus Postage.
DESCRIPTORS	Architectural Drafting; Behavioral Objectives; Building Plans; Career Exploration; *Communications; *Competency Based Education; Construction (Process); Course Descriptions; Electricity; *Electronics; Energy; Engineering Drawing; Evaluation Criteria; *Graphic Arts; *Industrial Arts; *Manufacturing; Metal Industry; Metals; Plastics; Power Technology; Program Descriptions; Secondary Education; Student Evaluation; Technology; Transportation; Vocational Education; Woodworking
IDENTIFIERS	*Materials Processing

ABSTRACT

This teacher handbook provides recommended goals and objectives and suggested measures for competency-based courses in the vocational program area of industrial arts. A background and overview section contains the philosophy and rationale, discusses thinking skills and programs for exceptional children, and provides notes that explain how to read the goals, objectives, and measures and offer suggestions for student placement, textbook use, and activities. This specific information is then provided for a vocational education competency-based curriculum: purpose and overview (target groups, philosophy, curriculum planning and design) and course of study. For industrial arts, grades 9-12, are offered a program description, learning outcomes, and scope and sequence. These courses are included in the curriculum: architectural drawing and planning, basic electricity/electronics technology, communications technology, construction technology, contemporary technology, energy/power and transportation, exploring technology, graphic arts technology, manufacturing technology, materials and processing, metals technology, plastics technology, technical drawing and planning, and wood technology. Materials provided for each course include a topical outline and a one-page format for each competency goal that details grade level, skills/subject area, the competency goal, objective(s), and measure(s) (suggestions of ways in which students may demonstrate their ability to meet the objective). (YLB)

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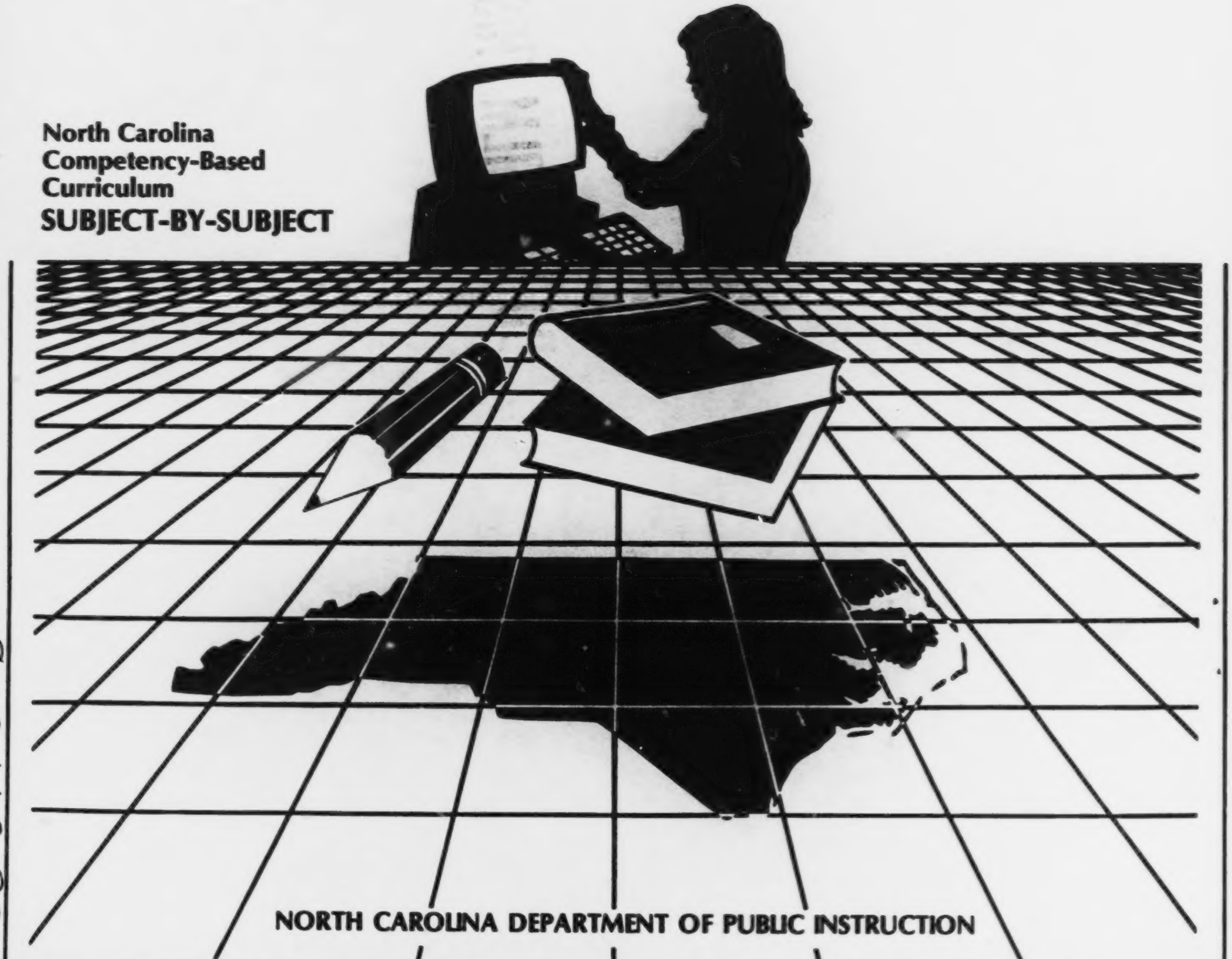
TEACHER HANDBOOK
INDUSTRIAL ARTS EDUCATION
VOCATIONAL EDUCATION

**North Carolina
Competency-Based
Curriculum
SUBJECT-BY-SUBJECT**



NORTH CAROLINA DEPARTMENT OF PUBLIC INSTRUCTION

CE 044 256

TEACHER HANDBOOK

VOCATIONAL EDUCATION

INDUSTRIAL ARTS EDUCATION

GRADES 9-12

North Carolina Competency-Based Curriculum

Division of Vocational Education
Instructional Services
North Carolina Department of Public Instruction

Raleigh, North Carolina
1985

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Foreword

As a result of the Elementary and Secondary School Reform Act of 1984 and the appropriation which accompanied this act, the North Carolina State Department of Public Instruction engaged in an extensive audit and revision of curriculum throughout the summer and fall of 1984. The products of this work, the North Carolina Standard Course of Study and the Teacher Handbook for the competency-based curriculum, provide a detailed, integrated basic course of study for all subjects at all grade levels.

The North Carolina General Assembly has also made a commitment to the development of a basic education program. This program includes the staffing and material support needed for the full implementation of the North Carolina Standard Course of Study and the competency-based curriculum in all public schools throughout the State. The financial support of the General Assembly and the work of educators throughout the State in developing the competency-based curriculum are important contributions to our continuing efforts to provide a quality education for every child residing in North Carolina.

A. Craig Phillips
State Superintendent of Public Instruction

Acknowledgements

The Instructional Services Area of the Department of Public Instruction acknowledges with gratitude the outstanding cooperation and assistance we have received from individuals and groups throughout the State of North Carolina. Without such cooperation, the development and printing of the North Carolina Standard Course of Study and the Teacher Handbook for the competency-based curriculum would not have been possible.

We wish to express a special thanks to:

- the North Carolina General Assembly for providing the funds to make this important work possible,
- more than 8000 local educators who participated in the writing of the documents and in reacting to early drafts,
- almost 300 persons from institutions of higher education who advised the staff and assisted in the development of the curriculum,
- Raleigh-based and regional staff in the Divisions of Arts Education, Communication Skills, Computer Services, Exceptional Children, Healthful Living, School Media Programs, Mathematics, Science, Social Studies, Student Services, and Vocational Education. These Public Instruction staff members carried the primary responsibility for planning, writing, and editing the curriculum.
- the Controller's Office in the Department of Education for excellent assistance in designing a computer program for storing and printing the Standard Course of Study and the competency-based curriculum,
- the Division of School-Community Relations for technical assistance in the publication of the documents,
- all areas of the Department of Public Instruction for their encouragement and invaluable assistance in numerous ways,
- Kay Barbour and Janice Royster who word-processed the entire 8000 pages, and
- especially Dr. Barbara Holland Chapman who coordinated the development of the Standard Course of Study and the competency-based curriculum. Her untiring efforts have contributed significantly to the quality of these documents.

The involvement of the entire education community in the writing of the curriculum truly makes it a North Carolina curriculum of which the State can be justifiably proud. We look forward in the coming years to working with all of you in revising and improving the competency-based curriculum in order that it will continue to meet the needs of the children of North Carolina.

Joseph B. Webb

Joseph B. Webb
Assistant State Superintendent
Instructional Services

BACKGROUND AND OVERVIEW

Introduction

Immediately following the passage of the Elementary and Secondary Reform Act in June of 1984, the area of Instructional Services within the North Carolina State Department of Public Instruction began a revision of the North Carolina Standard Course of Study and the development of the Teacher Handbook for the competency-based curriculum. These efforts represent a significant part of the development of a basic education program for North Carolina's Public Schools.

Three publications hold the results of our efforts to define a basic education program for the State: The Basic Education Program for North Carolina's Public Schools, North Carolina Standard Course of Study, and the Teacher Handbook for the competency-based curriculum. The Basic Education Program for North Carolina's Public Schools outlines the curriculum, programs not confined to subject areas, general standards, material support, and staffing which should be provided in all schools throughout the State. The North Carolina Standard Course of Study, adopted by the State Board of Education, provides an overview of the basic curriculum which should be made available to every child in the public schools of our State. It includes the subject or skills areas of arts education, communication skills, guidance, healthful living, library/media skills, mathematics, science, second language studies, social studies, and vocational education as well as the philosophy and rationale underlying the curriculum and considerations which should be made in developing thinking skills and providing for the needs of exceptional children. The Teacher Handbook for the competency-based curriculum provides recommended goals and objectives and suggested measures for each subject or skills area.

The first step taken in auditing and refining the curriculum in each subject or skills area was to review and synthesize the reports of curriculum review committees and the work contained in two earlier publications (Course of Study for Elementary and Secondary Schools K-12 and Competency Goals and Performance Indicators). The next step was to involve educators from local education agencies and institutions of higher education in working with the North Carolina Department of Public Instruction staff to expand and refine the curriculum. Thousands of persons throughout the State have been involved in the development of the North Carolina Standard Course of Study and the Teacher Handbook for the competency-based curriculum.

Three important points should be kept in mind when reviewing these documents. First, while the curriculum represents the standard course of study which should be available to all children in North Carolina Public schools, many public schools in the State presently offer an even more comprehensive curriculum. Second, the standard course of study includes the curriculum that should be made available to every child, not what every child is actually required to take. Required subjects or courses are outlined in the appendices.

Third, the *North Carolina Standard Course of Study* and the *Teacher Handbook* for the competency-based curriculum will never actually be completed. Several steps have been taken to insure that the curriculum may be constantly updated: the documents have been entered on an IBM 5520 computer word-processing program for ease of revision and updating; the competency-based curriculum has been produced in loose-leaf form so that revised or additional pages may easily be added; and included in each document is the name of a contact person within the State Department of Public Instruction to whom staff in local education agencies or others may send suggestions for additions or revisions (Appendix I). As with any viable curriculum, these documents must be constantly open to review, expansion, and revision in order that they continue to meet the needs of the children of the State of North Carolina.

Philosophy and Rationale

The philosophy and rationale underlying the North Carolina Standard Course of Study and the Teacher Handbook for the competency-based curriculum imply a context in which the curriculum will be implemented. What follows are definitions of the purposes for which the curriculum was developed and the principles incorporated into its development as well as descriptions of who will implement it and where it will be successfully implemented.

Purposes and Principles

The primary purposes of the North Carolina Standard Course of Study and the competency-based curriculum are (1) to help students become responsible, productive citizens and (2) to help students achieve a sense of personal fulfillment. It is clear that there are competencies which a student must develop in order to meet both of these purposes.

Students must develop the specific competencies needed to gain employment or continue their education. These competencies include critical thinking skills, skills with media and technology, and the basic content knowledge provided within a core curriculum (arts education, communication skills, healthful living, mathematics, science, second language studies, social studies, and vocational education).

Students must develop the skills and attitudes necessary to cope with contemporary society. Among these are a positive attitude toward oneself, a sense of independence and responsibility for oneself, an understanding of oneself and one's own culture, a positive attitude toward others including those who come from different cultures, a respect for the rights of others, a sensitivity to the needs and feelings of others, a sense of responsibility to others, a willingness to cooperate with others in working toward a common goal, and the ability to understand and cope with a constantly changing society.

In order to help students become responsible, productive citizens who have a sense of personal fulfillment, commonly accepted principles of learning have been incorporated into the North Carolina Standard Course of Study and the Teacher Handbook for the competency-based curriculum. One of these principles is the importance of integrating the curriculum--of emphasizing the understanding of concepts and processes over the mere acquisition of isolated facts. Stressing the mastery of integrated knowledge helps students to move from what is known to an understanding of the unknown, to see relationships and patterns and begin to make generalizations, to understand the interrelatedness of the subject areas and skills areas, and to succeed in learning. An integrated curriculum helps students learn how to learn.

Another principle considered in the development of the North Carolina Standard Course of Study and the Teacher Handbook for the competency-based curriculum is that learners are more likely to attempt those tasks at which they feel they can succeed and which are relevant to their lives. If students are to be successful in school and if they are to pursue lifelong learning, they must see learning as worthwhile. The competency-based curriculum is, therefore, a program of continuous learning based upon the individual student's needs, interests, and stages of development. The curriculum provides opportunities for the student to develop self-expression, to learn to communicate effectively, to maintain and develop both physical and emotional health, to choose among curriculum electives, and to become an active participant in the learning process. The importance of personalizing the curriculum to help each student reach her/his maximum potential is stressed.

Effective Teachers

It is the classroom teacher at each grade level or in each subject area who has the most direct influence on the implementation of the North Carolina Standard Course of Study and the competency-based curriculum. The ultimate task of integrating the curriculum must be performed by the classroom teacher through preparation for instruction and presentation of content. Student success in learning is assured when teachers use the information gained through monitoring and evaluation to determine appropriate instructional tasks and to provide appropriate feedback to students. What the teacher presents and how the teacher presents it determines whether students feel the task is relevant to their lives. The teacher's efficient management of instructional time and student behavior are also important to the successful implementation of the curriculum in each classroom.

Effective Schools

Several common characteristics will be present in the schools which most effectively implement the North Carolina Standard Course of Study and the competency-based curriculum. These characteristics include strong instructional and administrative leadership by the principal of the school, dedicated and qualified teachers, an emphasis on curriculum and instruction, a positive school climate, ongoing evaluation based on student achievement, and good home/school relations. Strong instructional and administrative leadership by the principal means that the principal functions as the instructional leader, supports instructional effectiveness by the way in which the school is managed, and clearly communicates the school's mission to staff, students, and parents. Dedicated and qualified teachers care about their students, understand and support school-wide goals and procedures, work as a team, exhibit positive morale and enthusiasm for their work, and demonstrate their good training through application of the skills involved in quality teaching. An emphasis on curriculum and instruction includes clearly stated school-wide goals and objectives, structured staff development based on the school's goals, curriculum continuity (alignment among school-wide goals, instructional approaches, materials used, and the assessment of students' needs, abilities, and interests), and a high percentage of student time-on-task. Elements of a positive school climate are a safe and orderly environment, a perceptible feeling of pride and school spirit in all that the school does, the communication of high academic and social expectations to students, and opportunities for student responsibility and involvement. Ongoing evaluation based on student achievement begins with early identification of students' needs, abilities, and interests, includes frequent monitoring of student progress in multiple ways (teacher observation, classroom activities, homework, teacher-made tests, mastery skills checklists, criterion-referenced tests), and results in appropriate instructional prescriptions to improve individual student performance and the school-wide instructional program. Good home/school relations are the outgrowth of effective, positive communication between the school and the home. This includes encouraging parents to help their children at home, making them feel they are appreciated by the school staff, and letting them know they are welcome in the school and have a part to play in school affairs. Good home/school relations increase parents' support of the school's instructional goals and disciplinary policies.

The characteristics described above will be found in the elementary, middle/junior high, and high schools which most effectively implement the North Carolina Standard Course of Study and the competency-based curriculum. However, in each of these schools consideration must be given to the unique development needs--intellectual, physical, social, and emotional--of the students served. For example, the need of young children for concrete, hands-on experiences; the need of middle school children for transitional experiences in curriculum choices, scheduling, and conseling; and the need of high school students for the variety of curriculum choices provided by the comprehensive high school.

The North Carolina Standard Course of Study and the competency-based curriculum represent a comprehensive, integrated course of study; however no document by itself has ever made the ultimate difference in the quality of education which children receive. Principals who function as instructional leaders and teachers who make use of their most effective teaching skills will appropriately implement the competency-based curriculum and thus insure that the children of North Carolina receive a quality education.

Thinking Skills

In order to become productive, responsible citizens and to achieve a sense of personal fulfillment, students must develop the ability to think. Thinking skills should be developed and reinforced throughout the curriculum and during every activity of the school day. It is also important that students be helped to apply these skills to "real life" situations outside the school.

The most frequently used system for classifying thinking skills is Bloom's (1956) Taxonomy. This system, with adaptations made by Sanders (1966) and Soar et al. (1969), was used in the integration of thinking skills throughout the Teacher Handbook for the competency-based curriculum. These skills fall into seven broad categories--memory, translation, interpretation, application, analysis, synthesis, and evaluation.

The most basic thinking skills are memory and translation. Memory involves the ability to remember specific pieces of information or facts such as names, dates, events, and rules. Translation requires the student to remember specifics and to understand or express them in her/his own terms. One example of a translation skill is the student's ability to restate a classroom rule in her/his own words. Another example is the ability to read the mathematical symbol "+" as "plus".

Remembering isolated bits of information or even restating that information in one's own words does not necessarily require reasoning on the part of the student. Higher-level thinking skills are defined as those processes which require thinking or reasoning above the levels of memory or translation--interpretation, application, analysis, synthesis, and evaluation.

Students begin to demonstrate their ability to reason through interpreting information, applying what is learned in one situation to a new situation, and analyzing information. Ways in which a student might demonstrate the ability to interpret information are to list the similarities and differences between two or more objects or to tell why a particular classroom rule was established. A student demonstrates a degree of ability in the category of application when s/he is able to explain how the principle of representative government at the state and federal levels may apply to the election of officers to the student council. A student who reads a newspaper editorial and is able to distinguish fact from opinion, point out unstated assumptions, and recognize bias is demonstrating skills of analysis.

When students apply skills of analysis, they are taking apart a whole. When students apply synthesis skills, they are creating a whole that is unique or new to them. Synthesis is usually equated with creativity. Composing a song, building a model house, or formulating a hypothesis during a science experiment are examples of synthesis activities.

Evaluation is distinct from opinion in that evaluation is the conscious making of judgments based on evidence or criteria. Opinion is usually formed from an emotional or affective base. Students serving as jurors during a simulated trial are using evaluation skills or making judgments based on evidence. Students critiquing one another's writing based on established elements of style are using evaluation skills or making judgments based on criteria.

To insure that students develop higher-level thinking skills they should be guided in the use of these skills in each subject area at each grade level and in their application to "real life" situations. When developing lesson plans, teachers should prepare tasks and questions at a variety of cognitive levels. However, strict adherence to previously prepared questions may inhibit rather than enhance a class discussion. Furthermore, it is often difficult to think of appropriately worded higher-level questions in the midst of a good classroom discussion. The following simple strategies will lead to the asking of higher-level questions and the giving of higher-level responses:

1. Before starting an activity, explain to the learner what you are going to do.
2. Before starting an activity, give the learner time to familiarize her/himself with the materials.
3. Ask questions which require multiple word answers.
   (e.g., "Why did he choose that path?")
4. Ask questions which have more than one correct answer.
   (e.g., "What things make people happy?")
5. Encourage the learner to enlarge upon her/his answer.
   (e.g., "Tell us more about that.")
6. Get the learner to make judgments on the basis of evidence rather than by guessing.
   (e.g., "You said . . . Read the line in the book that made you think that.")
7. Give the learner time to think about the problem; don't be too quick to help.
   (e.g., Wait at least five seconds before prompting or asking another question.)
8. Get the learner to ask questions.
   (e.g., "If the astronaut were in our classroom, what questions would you ask her?")
9. Praise the learner when s/he does well or takes small steps in the right direction.
10. Let the learner know when her/his answer or work is wrong, but do so in a positive or neutral manner. (Desirable Teaching Behavior Task Force, 1976)

The following are examples of two levels of activities (K-1 and above K-1) within the seven categories of thinking skills and two categories of questions or statements (affectivity and procedure) outside the seven categories of thinking skills:

Florida Taxonomy of Cognitive Behavior--K-1 Form (Soar et al., 1969)

1. Memory--items at this level are intended to represent no activity other than rote memory. The pupil is expected to give back an idea in the same form it was given, without changing the nature of the idea or the form in which it was expressed.

   a. repeats from memory
   b. repeats other
   c. repeats in sequence
   d. choral response
   e. spells
   f. gives/receives information
   g. seeks information

2. Translation--the intent of this category is to identify pupil activities involved in changing the form in which an idea is expressed, but not in changing or manipulating the idea itself.

   a. sounds letters
   b. names pictures, objects, colors, letters
   c. copies letter, number, work (learned)
   d. gives/follows directions
   e. describes situation, event
   f. reports experience (2+ thoughts)
   g. describes situation, event
   h. recognizes word (sight words)
   i. translates one language into another or vice versa
      (e.g., math symbols into words or Spanish into English)
   j. asks/gives permission
   k. puts into own words

3. Interpretation--the activities in this category are those of making comparisons, identifying similarities or differences, identifying relatedness, or carrying out a process in which the child has previously been instructed, when told that the process is appropriate.

   a. sounds out word
   b. classifies (1 attribute)
   c. counts
   d. adds/subtracts
   e. uses units, tens
   f. compares letters, numbers
   g. copies letters(s), number(s)--learning
   h. gives class name (vehicle, etc.)
   i. identifies similarities, differences
   j. asks/gives reason (opinion)
   k. names sensation
   l. performs learned task or process
   m. relates terms (e.g., 1/first, little/small, purple/violet/lavender)
   n. makes comparisons
   o. describes what may be seen to be happening in a picture

4. Application--one of the central aspects of application is that the student is able to select from past learning that which is appropriate for the current situation, and apply it. In interpretation a process was carried out when specified, but here the pupil must decide her/himself what process should be applied. Organization and the interrelationships between two or more ideas are central.

    a. classification (2+ attributes)
    b. directs learning game
    c. creates arithmetic problem
    d. writes/types sentence
    e. asks/tells who, what, or where
    f. seriates (alphabetizes)
    g. applies previous learning to new situation
    h. reads (thought unit)
    i. selects and carries out process

5. Analysis--the central elements in this category are those of inferring causation, motivation, or feelings from information given about the setting and the behavior of the people involved, or of identifying information which supports a conclusion, or establishing the accuracy of a process. The selection and use of relevant supporting data is the central process.

    a. verifies equation balance
    b. infers feeling or motive
    c. infers causality (tells why)
    d. cites evidence for conclusions

6. Synthesis--the central idea of the synthesis category is that the child organize ideas in a way that is new to her/him, or projects probable consequences of a given behavior, or formulates a plan or set of rules to deal with anticipated difficulties, or produces something which is new to her/him.

    a. elaborates on picture or story
    b. proposes plan or rule
    c. play-acts
    d. makes up story
    e. makes fantasied object (e.g., sand or clay)
    f. makes common object (e.g., sand or clay)
    g. draws/colors common object
    h. draws/colors fantasied object
    i. makes predictions based on available facts

7. Evaluation--the central concept of evaluation is that there must exist a set of standards or criteria against which behavior or some sort of product is compared.

    a. compares with criteria or rule
    b. compares with plan

Florida Taxonomy of Cognitive Behavior (Brown et al., 1968)

1. Knowledge (memory)

    1.1 Knowledge of Specifics--requires the memorization of information or knowledge which can be isolated or remembered separately, the smallest meaningful bits.

    - a. reads
    - b. spells
    - c. identifies something by name
    - d. defines meaning of term
    - e. gives a specific fact
    - f. tells about an event

    1.2 Knowledge of Ways & Means of Dealing with Specifics--requires knowledge about the manner in which specific information is handled--the ways of organizing, working, and evaluating ideas and phenomena which form the connecting links between specifics. It does not require the learner to deal actually with the specifics her/himself, but rather to know of their existence and possible use. Thus, s/he may be expected to state a previously encountered principle or generalization, but not to develop one. The items which belong to this category refer to processes rather than products of processes; they usually represent higher abstractions than the items of the preceding category.

    - a. recognizes symbol
    - b. cites rule
    - c. gives chronological sequence
    - d. gives steps of process, describes method
    - e. cites trend
    - f. names classification system or standard
    - g. names what fits given system or standard

    1.3 Knowledge of Universals & Abstractions--deals with the highest of abstractions at the memory level. In order to evidence this behavior the individual must know major generalizations, their interrelations, and patterns into which information can be organized and structured. These items reflect the major concepts which comprise the framework of a discipline or major area of knowledge. The four items in this category are descriptions of behavior which would identify or verbalize a major concept.

    - a. states generalized concept or idea
    - b. states a principle, law, or theory
    - c. tells about organization or structure
    - d. recalls name of principle, law, or theory

2. Translation--is dependent upon possession of relevant knowledge. The task is to convert communication into known terms; it requires the understanding of the literal message in the communication. Communication is used here in its broadest sense; it could be a demonstration, a field trip, a musical work, a verbal message, or be demonstrated in pictorial or symbolic form.

a. restates in own words or briefer terms
b. gives concrete example of an abstract idea
c. verbalizes from a graphic representation
d. translates verbalization into graphic form
e. translates figurative statement to literal statement or vice versa
f. translates foreign language into English or vice versa

3. Interpretation--individual not only identifies and comprehends ideas, as in translation, but also understands their relationships. It goes beyond repetition and rephrasing the parts of a communication to determine the larger and more general ideas contained in it. Thus, comprehension may require reordering into a new configuration in the mind of a person, involving the determination of the relative importance of ideas and the interrelationships. However, the thinking is dependent upon what is given to the student--s/he is not expected to bring abstractions from other experiences into the situation.

a. gives reason (tells why)
b. shows similarities or differences
c. summarizes or concludes from observation of evidence
d. shows cause and effect relationship
e. gives analogy, simile, metaphor
f. performs a directed task or process

4. Application--individual must know an abstraction well enough to be able to demonstrate its use in a new situation. The task is to bring to bear upon given material or situation the appropriate information, generalizations or principles that are required to solve a problem. Application, as distinguished from comprehension, involves transfer of training. It is based on an individual's being able to apply previous learning to a new or novel situation without having to be shown how to use it. The problem itself is given.

a. applies previous learning to a new situation
b. applies principle to new situation
c. applies abstract knowledge in a practical situation
d. identifies, selects, and carries out process

5. Analysis--describes cognitive behavior in which there is an emphasis on the breakdown of material into its parts in order to detect the relationships of the parts and the way they are organized. The first four items at this level describe skills used in the identification or classification of the elements of the communication.

a. distinguishes fact from opinion
b. distinguishes fact from hypothesis
c. distinguishes conclusions from statements which support it
d. points out unstated assumption
e. shows interaction or relation of elements
f. points out particulars to justify conclusion
g. checks hypothesis with given information

   - h. distinguishes relevant from irrelevant information
   - i. detects error in thinking
   - j. infers purpose, point of view, thoughts, feelings
   - k. recognizes bias or propaganda

6. Synthesis (creativity)--represents cognitive activities in which the individual puts together elements and parts in order to form a whole in such a way as to constitute a pattern or structure that was not stated before. This entails recombining parts of earlier experiences in a new organization that is unique to the synthesizer. In analysis, the person takes apart a given whole; in synthesis s/he creates a whole.

   - a. reorganizes ideas, materials, processes
   - b. produces unique communication or divergent idea
   - c. produces a plan, proposed set of operations
   - d. designs an apparatus
   - e. designs a structure
   - f. devises scheme for classifying information
   - g. formulates hypothesis, intelligent guess
   - h. makes deductions from abstract symbols, propositions
   - i. draws inductive generalization from specifics

7. Evaluation--describes activities of conscious judgment making; involves use of criteria or standards to determine the worth or value of methods, materials, or ideas. Evaluations must be distinguished from opinions which are usually made from an emotional or affective base.

   - a. evaluates something from evidence
   - b. evaluates something from criteria

Noncognitive Categories of Questions/Statements or Tasks (Davis & Tinsley, 1967)

Affectivity--questions/statements or tasks which elicit feeling, emotion, or opinion without a standard of appraisal, e.g., "How does the story make you feel?" or "Wasn't that a good story!"

Procedure--questions/statements or tasks related to organization, behavior, or management, e.g., "Are you listening to me?" or "Please get ready for class to begin."

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Programs for Exceptional Children

Exceptional children are (1) learners who because of permanent or temporary mental, physical, or emotional handicaps need special education and are unable to have all their educational needs met in a regular class without special education or related services, or (2) learners who demonstrate or have the potential to demonstrate outstanding intellectual aptitude and specific academic ability and, in order to develop these abilities, may require differentiated educational services beyond those ordinarily provided by the regular school program. Classifications of exceptional children include those who are autistic, academically gifted, hearing impaired (deaf or hard of hearing), mentally handicapped (educable, trainable, or severely/profoundly), multi-handicapped, orthopedically impaired, other health impaired, pregnant, behaviorally/emotionally handicapped, specific learning disabled, speech/language impaired, and visually impaired (blind or partially-sighted).

The primary purpose of exceptional children programs is to insure that handicapped and gifted learners develop mentally, physically, and emotionally to the maximum extent possible through the provision of an appropriate, individualized education in the proper setting.

Curricula for most exceptional learners follow the curricula designed for learners in general education. However, modification of instructional programs, creative instructional approaches, individualized programming, and appropriate selection and use of curricula are necessary to meet the special needs of exceptional learners. In curricula, emphasis must be given to instruction in arts education, communication skills, healthful living, mathematics, library/media skills, science, social studies, and vocational education. Attention must be focused upon cognitive, affective, psychomotor, and vocational development within the curricular areas. The Individualized Education Program for the handicapped and the Group Education Program for the academically gifted, both of which are based upon a comprehensive assessment, are to state in writing the special curricular offerings to be provided to each exceptional learner.

The Individual Education Program for the handicapped requires objective criteria, evaluation procedures, and schedules for determining, on at least an annual basis, whether or not short-term instructional objectives have been achieved. The Group Education Program for the academically gifted requires annual goals and evaluation methods. All special education instruction provided to handicapped and academically gifted learners is to be individualized and designed to meet unique learning needs.

Learning outcomes--knowledge, skills, concepts, understandings, and attitudes--for the handicapped and the academically gifted will differ from learner to learner. For many exceptional learners, the same learning outcomes developed for learners in general education will be appropriate. Some exceptional learners will meet the learning outcomes at a different time and in a different manner than learners in general education. Some handicapped learners might not meet the learning outcomes in general education and will need a totally different curriculum.

The majority of handicapped and academically gifted learners spend a portion of their instructional day within general education, integrated into classes with non-handicapped and nonacademically gifted learners. General education teachers, as well as exceptional education teachers, must be familiar with curricula and capable of selecting appropriate curricular goals and objectives based upon the unique educational needs of each learner as determined by comprehensive assessment, and as stated in the Individualized Education Program for exceptional learners, emphasis needs to be placed on instructional techniques rather than differentiated or modified curricula.

While the general education curricula are appropriate for most exceptional learners, there are times when the teacher must vary the curricular content: some children are not ready for certain types of curricular content at the usual age; some disabilities prevent or make difficult participation in certain learning experiences; different levels of ability may limit or encourage participation in certain school subjects; and some learners spend less time in school. Curricular choice is determined by need.

Curricular goals must be oriented toward skills and application instead of general knowledge. The goals must include skills related to maintaining health, communicating ideas, achieving personal and social growth, handling money concerns, working with measurements, getting along in an expanding community, coping with the physical environment, maintaining a home, using leisure time, and career development.

The competency-based curriculum is to be maximized for exceptional learners. Teachers must be familiar with the curriculum, making judicial use of it in the instructional program for handicapped and academically gifted learners.

Notes to Those Using the TEACHER HANDBOOK

The North Carolina Standard Course of Study, adopted by the State Board of Education, provides an overview of the basic curriculum which should be made available to every child in the public schools of our State. It includes the subject or skills areas of arts education, communication skills, guidance, healthful living, library/media skills, mathematics, science, second language studies, social studies, and vocational education as well as the philosophy and rationale underlying the curriculum and considerations which should be made in developing thinking skills and providing for the needs of exceptional children. The Teacher Handbook for the competency-based curriculum provides recommended goals and objectives and suggested measures for each subject or skills area.

Definitions

Competency Goals:	broad statements of general direction or purpose.
Objectives:	specific statements of what the student will know or be able to do.
Measures:	a variety of suggestions for ways in which the student may demonstrate s/he is able to meet the objective.

How to Read the Goals, Objectives, and Measures

Competency Goals have been written as complete sentences stating why the learner should be able to meet the stated objectives, e.g., "The learner will know causes and events of the settlement of the West."

For purposes of clarity and brevity Objectives have been written as phrases or clauses beginning with a verb, e.g., "Know the importance of railroads in the settlement of the West." These phrases or clauses would logically be preceded by "The learner will (know the importance of railroads in the settlement of the West)."

For purposes of clarity and brevity Measures have also been written as phrases or clauses beginning with a verb, e.g., "Describe the advantages of the railroad over horse-drawn wagon, river transportation, and other commonly used methods of transportation." These phrases or clauses would logically be preceded by "One way (or some ways) a student may demonstrate s/he is able to meet successfully the objective is to (describe the advantages of the railroad over horse-drawn wagon, river transportation, and other commonly used methods of transportation)."

Appendix E is an example of a page from the Teacher Handbook for the competency-based curriculum.

Student Placement

From kindergarten through eighth grade each skill or subject area has been divided into grade levels. This was done in order to make it easier for teachers to gain a general idea of what should be covered at each grade level. In order that instruction fit the individual needs of each student, it is most important that the classroom teacher use the activities in the Measures column to determine the appropriate placement for each child. For example, if a second-grade student is not able to complete successfully the Measures in the reading skills section at the second-grade level, Measures at the first-grade or kindergarten level should be administered. When the base level at which the child can perform successfully has been determined, instruction should begin with and proceed from that level of Competency Goals and Objectives.

The Measures column includes a variety of suggested means for assessing student performance including informal measurements (e.g., manipulatives, oral reports, role playing, projects, and some paper and pencil activities) and formal measurements (e.g., items for teacher-made tests, criterion referenced tests, and/or standardized tests). Some of the items in this column may be administered in whole-group or small-group situations; others should be given only to individual students. These items may be used for the purpose of pretesting to determine appropriate student placement, for monitoring ongoing student progress, and/or for post-testing to determine student learning.

It is apparent that in order for students to be placed appropriately for instruction (particularly in first through eighth grade), each teacher must have at least one, and preferably two or more, grade levels of the competency-based curriculum on each side of the grade s/he is teaching. It must be remembered that the higher the grade level the greater the span of students' needs and, therefore, the greater the need for a teacher to have a wider grade span of the curriculum available. An adequate grade span of the curriculum is also important for teachers of exceptional children at all grade levels.

Responsibility for Implementation

The North Carolina Standard Course of Study specifies which skills and subjects are to be taught at each grade level from kindergarten through grade twelve. The skills to be taught or developed at all grade levels are communication skills, library/media skills, thinking skills, and affective skills. The subjects to be taught from kindergarten through grade six are arts education, healthful living, mathematics, science, second language studies, and social studies. The same subjects, with the addition of vocational education, are to be taught in grades seven through twelve.

The *Teacher Handbook* for the competency-based curriculum provides recommendations for what should be taught in each skills or subject area from kindergarten through eighth grade and in each course from ninth through twelfth grade. Each teacher's primary responsibility is to teach the subject(s) or courses which s/he is specifically assigned, as well as to help students develop thinking and affective skills. However, each teacher also has a responsibility for appropriately integrating other skills (communication, library/media) and subjects (arts, healthful living, mathematics, science, second language studies, social studies, and vocational education) into the skills or subject areas which are her/his specific assignment.

Teachers in departmentalized schools at the middle/junior high or secondary levels have a responsibility for integrating curriculum in several ways. These include: (1) the integration of curriculum within their subject area in order to help students to make a smooth transition from one level to the next, e.g., from English I to English II, from Algebra I to Algebra II, from French II to French III; (2) the appropriate integration and development of those skills which are every teacher's responsibility (thinking and affective skills); and (3) whenever appropriate, the integration of other skills and subjects into their specifically assigned subject or skills area.

The *Teacher Handbook* for the competency-based curriculum serves as a resource guide for the integration of all skills and subjects in departmentalized situations. Teachers may look over the curriculum within the specific skills or subject area for which they are responsible in order to determine the overall scope and sequence. They may look at the outlines for thinking and affective skills in order to determine which of those skills have been integrated into their particular segments of the curriculum or to determine how they may integrate additional thinking and affective skills. Looking over other skills and subject areas will help teachers determine what should be appropriately integrated into their own areas. For example, while it is a primary responsibility of the high school English teacher to teach writing and speaking skills, the high school social studies teacher must be familiar with those skills and has a responsibility for reinforcing those skills in the written and oral work done in the social studies classes. Prior to beginning written and oral reports the social studies teacher should review the writing and speaking skills portions of the communications skills curriculum, using these as guidelines for instruction and the development of student assignments. Similar examples could be given with mathematics and science teachers or English and vocational education teachers.

Teachers in self-contained classrooms at the elementary, middle/junior high, or high school levels have the primary responsibility for integrating the curriculum in a variety of ways. These include: (1) integrating the curriculum within each skills or subject area in order to help students make a smooth transition from one grade level to the next; (2) integrating thinking skills and affective skills throughout all areas of the curriculum; (3) the integration of skills and subjects whenever possible though units of study;

(4) integrating skills and subjects introduced by teachers or specialists outside the homeroom into what is being taught within the homeroom; and (5) coordinating the efforts of teachers outside the homeroom (teachers of arts education, physical education, exceptional children, and library/media specialists, or guidance counselors) in order to supplement the homeroom curriculum. The Teacher Handbook for the competency-based curriculum serves as a guide for the integration of skills and subjects in self-contained situations as it does in departmentalized situations.

The principal shares in the responsibility for the successful implementation of the competency-based curriculum. The implementation and integration of the curriculum should be the focal point for decisions made by the principal in the role of instructional and administrative leader. Decisions made with respect to scheduling, disposition of student discipline, uninterrupted time for classroom instruction, and the distribution of materials and supplies may each serve to facilitate or frustrate the successful implementation and integration of the curriculum.

Staff within the area of Instructional Services at the North Carolina Department of Public Instruction also share responsibility for the successful implementation of the competency-based curriculum. Staff from the Regional Education Centers and Raleigh are, of course, available to assist Local Education Agencies in the implementation of the curriculum.

Use of Textbooks

The North Carolina Standard Course of Study is the curriculum approved for the public schools of North Carolina. Textbooks supplement this curriculum. With reference to their appropriateness for use with the North Carolina Standard Course of Study, textbooks are reviewed and recommended by the Textbook Commission. The State Board of Education then adopts a list of textbooks from which school districts make individual selections. Appendix G is a description of this process. If textbooks are at variance with the curriculum, the North Carolina Standard Course of Study takes precedence.

Computer Access

The North Carolina Standard Course of Study and the Teacher Handbook for the competency-based curriculum (with the exception of mathematics grades 7-12) have been entered on the IBM 5520 computer at the State Department of Public Instruction. Each skills or subject area at each grade level has been entered as a separate document. This allows Local Education Agencies, Institutions of Higher Education, and others with access to the mainframe in Raleigh to call up and print out any portion of the curriculum, e.g., any skills or subject area across all grade levels, all skills and subjects for one particular grade level, one subject at one grade level, or the entire competency-based curriculum. Those with access to the mainframe will, therefore, have immediate access to any revisions or additions to the curriculum.

Activities and Resources

The development or cataloging of activities and resources to assist in the implementation of the competency-based curriculum is an ongoing activity of Instructional Services staff working with teachers and others in each of the Local Education Agencies. Concentrating this effort in the local school districts provides teachers the opportunity to become familiar with the curriculum. As activities and resources are developed for each skills or subject area, they will be made available for State-wide dissemination through the IBM mainframe.

Working Space

Working space has been left at the end of goals throughout the Teacher Handbook for the competency-based curriculum. This space has been provided so that teachers may write in additional objectives and measures and/or make notes regarding instruction, activities, and resources.

How to Make Suggestions for Additions or Revisions

As with any viable curriculum, the Teacher Handbook for the competency-based curriculum must be open to constant review, expansion, and revision in order that it continue to meet the needs of the children of this State. Anyone having suggestions for additions to or revisions of this curriculum may complete and submit the form in Appendix I, or may contact:

Joseph B. Webb
Assistant State Superintendent
for Instructional Services
Education Building
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Industrial Arts Education

COMPETENCY-BASED CURRICULUM

NORTH CAROLINA DEPARTMENT OF PUBLIC INSTRUCTION

VOCATIONAL EDUCATION

PURPOSE AND OVERVIEW

The overall mission of vocational education in the public schools is to provide a program capable of meeting the individual needs, interests, abilities, and aspirations of each student which is realistic in light of actual or anticipated opportunities for gainful employment, advanced education, and practical life application.

Specific purposes of vocational education are to:

1. Prepare individuals for entry-level employment in recognized occupations, new occupations, and emerging occupations at various levels of competence.

2. Prepare individuals for participation in advanced or highly skilled post-secondary vocational and technical education.

3. Provide individuals with laboratory experiences and activities which assist them in the making of informed and meaningful occupational choices, and/or which serve as the foundation for skilled vocational-technical education.

4. Provide individuals with laboratory experiences and activities which assist them in: (a) making informed consumer decisions; and (b) the application of practical life skills.

Competency-based courses are offered in eight vocational program areas:

1. Prevocational Education
2. Agricultural Education
3. Business and Office Education
4. Marketing Education
5. Health Occupations Education
6. Home Economics Education
7. Industrial Arts Education
8. Trade and Industrial Education

Vocational education provides appropriate programs and/or supportive services for persons who have academic, socioeconomic, and/or other disadvantages or handicaps that prevent them from succeeding in regular programs. It serves both in-school and out-of-school youths as well as adults.* Guidance, placement, and follow-up are also integral components of this program.

Target Groups

The major target group to be served by vocational education programs are youths in grades 7-12. In planning a vocational education competency-based curriculum, the following groups are listed in priority order for determining which target populations are to be served:

1. Students desiring immediate employment upon termination of high school. This group may include those who drop out or who graduate from high school, and desire to enter directly into the labor force.

2. Students who will engage in nongainful employment. This group includes students who apply their vocationally-related skills in situations without receiving pay. Examples are homemakers and volunteers.

3. Students who will engage in post-secondary training and education at less than the baccalaureate degree level. This group includes those persons who will pursue one-year, two-year, or other training programs in business schools, apprenticeship programs, technical colleges, and technical institutes, but who will not pursue a four-year college program. It may also include students who go directly into the military from high school.

4. Students who will pursue four-year or longer-term college degrees in fields related to vocational program areas.

5. Students who pursue nonvocationally-related college programs and who wish to develop practical life skills related to vocational educational and/or to develop certain vocationally-related skills transferable to other career settings.

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*NOTE: For purposes of this publication, "youths" is defined as persons between the ages of five and eighteen. "Adults" refers to the those persons over the age of eighteen. This is in support of, and not in conflict with, adult education provided by the community college system.

Philosophy

The State Board of Education has responsibility for providing direction and leadership to vocational education. This leadership is provided through the Master Plan for Vocational Education and other federally required plans.

The Master Plan encompasses all activities and programs, provides the framework for all other plans, and incorporates the vocational education philosophy of the State Board of Education. Implied within the philosophy of the State Board of Education are the following:

1. Vocational courses should be open to students regardless of race, sex, national origin, or handicapping conditions. Appropriate programs should be made available to students who have left high school and wish to pursue a course of study.

2. Teaching transferable skills and knowledge is important in preparing students to become adaptable in a changing work environment.

3. General education and vocational education are interdependent. General education programs should provide an awareness of career opportunities in their fields and how each is applied in the world of work. Vocational instruction should provide opportunities for students to apply communication and computation skills and other general education learnings to special occupational areas.

4. Employment needs and student aspirations should determine which occupational programs to offer with employment needs taking priority.

5. High quality vocational education programs require extensive planning with policies and guidelines from the state and federal government providing direction.

6. Input from local advisory committees, employment data, student surveys, and student follow-up are all necessary in planning, implementing, and evaluating local vocational programs.

7. Each student should be furnished written documentation of specific competencies achieved through participation in a vocational education program.

8. Counselors and all vocational teachers should form linkages with business, industry, and the community to increase the relevance of school for the work place. As a result, students should have the opportunity to participate in cooperative work experiences, internships, shadowing, and apprenticeships.

9. All students in vocational education should have an opportunity to develop and extend their learnings through participation in active vocational student organizations. The program of work for each

organization should be based on instructional competencies and be an integral part of the vocational program.

10. Strong vocational guidance, counseling, job placement, and follow-up services should be available to assist students in planning for their careers and enrolling in appropriate courses.

Planning and Designing the Curriculum

Trends in our society, as well as specific factors in the economy, technology, educational system, and the labor market influence planning an appropriate vocational education program. Vocational education planners need to design programs which will accommodate:

1. The availability of resources.
2. Changes in population characteristics.
3. Labor needs in new and emerging occupations, including small business ownership.
4. Labor needs in existing occupations with greater than average anticipated growth.
5. The rapid rates of increase in employment projected for the service sector of the public and private economy.
6. A projected decrease in occupations requiring a four-year college preparation.
7. The rapid changes in consumer technology.
8. Changes in individual and family lifestyles.

When designing the curriculum for a given school or the total school system, local planning personnel will need to organize a comprehensive and appropriate sequence of vocational offerings for students enrolled in grades 7-12 based on an assessment of the (1) student needs, interests, and aspirations, and (2) labor market demands and projections.

The following figure illustrates the minimal/ideal number of vocational program areas from which offerings may be selected to accommodate the elective program for a balanced, comprehensive secondary school system.

COURSE OF STUDY

MINIMUM PROGRAM	DESIRABLE PROGRAM	HIGHLY DESIRABLE PROGRAM*
Prevocational Program	Prevocational Program	Prevocational Program
PLUS	PLUS	PLUS
Introductory/Skill Development in a Single Sequence in no less than Three Program Areas	Introductory/Skill Development in Multiple Sequences in no less than Five Program Areas	Skill Development in Multiple Sequences in Seven Program Areas
		PLUS
		Specialized Non-sequenced Courses

*In a highly desirable program, students would also be provided the opportunity to participate in independent study or independent study combined with challenge exams for credit in programs which cannot be offered as formal courses in the school system.

Priority is to be given to the vocational skill development component of the program. However, planning must ensure that through the selection and combination of specific course offerings from the eight program areas, all students in grades 7-12 are given a chance to explore the world of work, begin to appraise their own individual talents, interests, aptitudes, and obtain vocational knowledge, skills, and attitudes in preparation for advanced training activities and/or practical life situations.

Within any program area of vocational education, the scope and sequence of course offerings may vary from district to district. In some program areas, it may take three or four courses to have a basic program while other program areas may require only one or two. What is basic in vocational education in any of the eight program areas is dependent upon the unique needs of an individual school district. To determine what is basic to a particular program area contact the district vocational education coordinator and review the Vocational Education: Program of Studies, Revised.

INDUSTRIAL ARTS EDUCATION

Program Description

Industrial Arts Education in North Carolina is defined as a study of technology and industry that provides opportunities for students to develop technological literacy and practical life skills through meaningful classroom and laboratory activities. These activities include problem-solving (critical thinking/decision-making), designing, and constructing with tools, machines, materials, and processes.

The school prepares youths for the world in which they live. Since American society is distinctly characterized as industrial and/or technological, it becomes the function of schools to give every student an insight into, and understanding of, the technological nature of the society. This is what the program of industrial arts strives to do. It acquaints persons of all ages and both sexes with the basic aspects of industry and technology.

Recognizing the individual's inherent potential for reasoning and problem solving, for imagining and creating, for constructing and expressing with materials (from which comes technology and industry) Industrial Arts seeks to develop content and experiences to contribute to the growth and development of human beings commensurate with their potential. Thus, Industrial Arts is a basic and fundamental study for all persons regardless of educational goal or occupational pursuit.

Moreover, Industrial Arts enables students to: recognize and experience the integration and application of Industrial Arts knowledge and skills toward leisure and special interests, become knowledgeable about potential work/career opportunities, become better consumers of the products of industry and technology, and plan their educational opportunities (technical/professional). In addition, Industrial Arts Education provides students with fundamental knowledge and skills which will enable them to enter and pursue more in-depth training in selected trades and industrial occupations.

Opportunities to develop and apply leadership, social, civic, and technologically-related skills are provided through the Association for Industrial Arts Students of America (AIASA), the vocational student organization for Industrial Arts Education students.

Learning Outcomes

As an integral part of the total school curriculum, Industrial Arts Education programs are designed to enable students to:

1. Develop insight and understanding of technology and industry and its place in our culture.

2. Develop technical literacy skills that will assist them in becoming competent and productive citizens.

3. Develop creative, problem-solving, and decision-making abilities (critical thinking).

4. Discover and develop their individual talents, aptitudes, interests, and individual potential as related to our technological environment.

5. Develop a measure of skill in the use of tools, materials, and processes as both consumers and potential workers.

6. Develop attitudes and habits of safety.

Scope and Sequence of Industrial Arts Education

The scope and sequence of Industrial Arts Education fundable through vocational education includes varied content and experiences for students in grades 7-12. Students may enter and progress through one of the several program sequences in order to achieve their major objectives in the Industrial Arts Education program.

Concepts and experiences related to Industrial Arts Education contribute to three major levels of growth and development for children within the public schools. They are: (1) learning reinforcement of basic instructional areas, (2) exploratory/practical life skills, and (3) pretechnical/professional/personal consumer skills.

Elementary

Industrial Arts concepts at this level are integrated with regular instruction. These serve to establish technical literacy in terms of vocabulary, comprehension, word attack skills, and math skills. The approach is to utilize Industrial Arts "doing" aspects as a motivational technique. The purpose is learning reinforcement.

Junior High/Middle School

The middle/junior high school program provides opportunities to apply technical literacy concepts acquired at the elementary school. Exploring technology is offered at grade 7, and Contemporary Industries is offered at grade 8. The first semester in each 7th and 8th grade offering serves as the "introductory" instructional area. The courses provide instruction that may be applied as (1) practical life skills or (2) prevocational information for further educational planning.

High School

Industrial Arts at the high school level serves as an applied laboratory to gain knowledge and skill to use in several ways. Through a variety of course offerings it provides further opportunity for students continuing in Industrial Arts as well as for students who are enrolling for the first time. The focus is toward providing instruction in each of the course offerings that may be applied toward advancing in education (pretechnical or professional) and developing practical life knowledge and skills.

Special Note:

Practical Life Skills: Instruction in practical life skills is a major component of all Industrial Arts programs. Practical life skills are viewed as knowledge and skills which enable a person to function as a better consumer and which enrich the recreational and avocational life of the individual. Problem-solving and decision-making patterns are combined with the concrete skills in consumer choice, use, and maintenance of goods produced by society's technology as well as in personal interest areas of the individual. All courses cited in the program scope and sequence in Industrial Arts provide opportunity for the development of practical life skills in individual students.

The scope and basic offerings in Industrial Arts Education at the high school level include:

- Manufacturing
- Construction
- Communication
- Energy/Power and Transportation
- Technical Drawing and Planning
- Materials and Processing

In addition to the traditional or basic offerings, the more comprehensive programs in Industrial Arts Education may include one or more specialized offerings based upon the needs of the local community. Possible specialized or supplemental local offerings within Industrial Arts Education include:

- Architectural Drawing and Planning
- Basic Electricity/Electronics
- Graphic Arts
- Metal Technology
- Plastics Technology
- Wood Technology

The following chart provides an example of the scope and sequence of these program offerings for a given situation in which a comprehensive program is possible.

SAMPLE SCOPE AND SEQUENCE FOR INDUSTRIAL ARTS EDUCATION

K-5(6)	Grade 7	Grade 8	Grades 9-12
*Elementary Industrial Arts	Exploring Technology (S/Y)	Contemporary Technology (S/Y)	Manufacturing Technology (S/Y) Construction Technology (S/Y) Communications Technology (S/Y) Energy/Power & Transportation (S/Y)

*Note: While this is part of the scope for Industrial Arts Education, expenditures from Vocational funds are restricted to Grades 7-12

Specialized Unit Shop Courses

Grades 10-12

Technical Drawing & Planning (S/Y)

Materials & Processing Technology (S/Y)

Basic Electricity/ Electronics Technology (S/Y)

Wood Technology (S/Y)

Plastics Technology (S/Y)

Metals Technology (S/Y)

Graphic Arts Technology (S/Y)

Architectural Drawing & Planning (S/Y)

NOTE: Y = 1 year S = 1 semester

Courses are shown at first grade level to be offered and may be offered at any succeeding grade level.

As illustrated in the chart, the total scope and sequence of Industrial Arts Education includes varied content/experiences for students in grades K through 12. Students may enter and progress through one of the several program sequences in order to achieve their major objectives within Industrial Education.

"Exploring Technology" is offered at grade 7 to provide prevocational instruction in Industrial Arts. Instructional experiences are provided in four cluster areas: Manufacturing, Construction, Communication, and Energy/Power and Transportation. These cluster areas are designed to: include hands-on experiences relating to tools, materials, and processes in the area; teach about technology and industry; provide an awareness of broad career possibilities; and identify further educational opportunities in secondary and postsecondary schools. Where Exploring Technology is offered at grade 7, students at the next level (grade 8) elect Contemporary Industries.

When students have been enrolled in the Industrial Arts Education exploratory courses or in the Prevocational Education-Industrial Lab at grade 7 and 8, they elect from the following semester courses at grade 9: Manufacturing (drawing, woods, synthetics, metal), Construction (drawing, woods, synthetics), Energy/Power (fundamentals of energy/power sources, generation, transmission, application, conversion, and utilization of basic power units), and Communication (electronic, visual, and graphic).

Students follow grade 9 semester offerings by electing at grade 10 from the following unit shop introductory courses: Wood Technology, Metals Technology, Plastics Technology, Technical Drawing and Planning, Architectural Drawing and Planning, Basic Electricity/Electronics, Energy/Power and Transportation, and Graphic Arts. Unit shop introductory courses allow students to pursue and develop introductory knowledge and basic skill which is pretechnical (preparation for advanced training), could lead to enrollment in vocational skill development instruction in Trade and Industrial Education, and/or could satisfy a preprofessional or special interest. It should also be noted that students in grades 11 and 12 may take introductory courses identified at grade 10.

Architectural Drawing and Planning Outline

1. Introduction to Architectural Drawing/Planning

2. Career Information

3. Drawing Instruments

4. Consideration in Planning a House

    a. Basic house design
    b. Primary consideration

5. Alphabet of Lines

6. Sketching Techniques to Architectural Plans

    a. Rough sketch
    b. Two-point perspective

7. Plot Plan in Architectural Drawing

    a. Function of plot plan
    b. Draw the plot plan

8. Representation of Building Components and Materials in an Architectural Drawing

9. Elevations in Architectural Drawing and Planning

    a. Purpose and function of elevation
    b. Requirements for drawing elevation
    c. Geometric construction
    d. Roof pitch calculation

10. Foundation Plans

    a. Footing and foundations
    b. Purpose and function of foundation plans

11. Architectural Floor Plan

    a. Planning sleeping, living, and service area
    b. Exterior and interior doors
    c. Windows
    d. Function of floor plan
    e. Procedures for drawing floor plan
    f. Electrical plan

12. Fireplaces and Chimneys

13. Climate Control Systems

    a. Heating and air conditioning
    b. Estimating a climate control system

Grade Level: 10-12 Skills/Subject Area: Architectural Drawing and Planning

COMPETENCY GOAL 1: The learner will identify the objectives and purposes of the industrial arts course, Architectural Drawing and Planning.

Objectives		Measures	
1.1	Describe the basic purposes and aims of architectural drawing and planning.	1.1.1	What are the objectives of the industrial arts course, Architectural Drawing and Planning?
1.2	Describe the role of architectural drafting in the world of work.	1.1.2	Explain a variety of uses for architectural drafting.
1.3	Distinguish between architectural and technical drawing.	1.1.3	What are the differences between architectural drawing and technical drawing?

Grade Level: 10-12 Skills/Subject Area: Architectural Drawing and Planning

COMPETENCY GOAL 2: The learner will relate career information about architectural drawing and planning with human knowledge, skills, abilities, and attitudes.

	Objectives		Measures
2.1	Identify personal interests, physical characteristics, aptitudes, and mental abilities.	2.1.1	Using the headings listed below, identify your unique strengths: a. personal interests b. physical characteristics c. aptitudes d. mental abilities
2.2	Identify possible career options consistent with abilities and aptitudes.	2.2.1	List three possible careers in architecture that fit your abilities and aspirations.
2.3	Describe the "transfer of skill" as it relates to tentative occupational career goals.	2.3.1	Explain how value judgments can affect your lifestyle and career aspirations.
2.4	Describe how value judgements affect lifestyles and career aspirations.	2.4.1	Describe the relationship between attitudes and success in life and work.
2.5	Describe the relationship between attitude and success in life and work.	2.5.1	Describe "transfer of skill" as as it applies to tentative occupational career goals.
2.6	Use decision-making processes in making occupational choices.	2.6.1	Choose an occupation in architecture and demonstrate how s/he uses the decision-making process.
2.7	Identify educational and financial requirements for achieving tentative career goals.	2.7.1	Identify a tentative career goal and describe the education and financial requirements.

Skills/Subject Area: Architectural Drawing and Planning

COMPETENCY GOAL 2: The learner will relate career information about architectural drawing and planning with human knowledge, skills, abilities, and attitudes.

Objectives	Measures
2.8 List a cluster of occupations.	2.8.1 Name a cluster of occupations in architecture.
2.9 Identify desirable employee traits and work habits (e.g., dependability, cooperation, pride in work).	2.9.1 List the traits of a good employee.
2.10 List training opportunities at the high school, post-secondary, and college or university level.	2.10.1 Identify the types of jobs that one might expect as a result of a. high school training b. post-secondary training c. college/university training

VOCATIONAL EDUCATION
INDUSTRIAL ARTS EDUCATION

Grade Level: 10-12 Skills/Subject Area: Architectural Drawing and Planning

COMPETENCY GOAL 3: The learner will demonstrate the ability to choose and use drawing instruments correctly.

Objectives	Measures
3.1 Identify basic drawing instruments.	3.1.1 Sketch a picture of a pair of dividers and explain how they differ from a compass.
	3.1.2 Explain the divisions and use of an architect's scale.
	3.1.3 Explain the purpose of a french curve.
	3.1.4 Which instrument, bow compass or friction joint compass, is best for drawing small circles?
3.2 Use drawing instruments accurately.	3.2.1 Lay out the following distances with an architect's scale: 12' - 3" - Scale ¼" = 1' - 0 13' - 6" - Scale ½" = 1' - 0 18' - 6" - Scale 1/8" = 1' - 0
	3.2.2 Divide a 3 5/8" line into 8 equal parts using a divider.
	3.2.3 Sharpen correctly the lead on a compass.
	3.2.4 Draw a smooth curve using a french curve.
	3.2.5 Divide a circle into 24 equal parts by using the T - Square, the 30° - 60° triangle, and the 45° triangle.
	3.2.6 Lay out a 37° angle using a protractor.

VOCATIONAL EDUCATION
INDUSTRIAL ARTS EDUCATION

Grade Level: 10-12

Skills/Subject Area: Architectural Drawing and Planning

COMPETENCY GOAL 4: The learner will describe house styles and a variety of considerations in planning a house.

Objectives		Measures	
4.1	Identify basic house designs and describe the advantages/disadvantages of each.	4.1.1	What is the chief advantage of a split-level house?
		4.1.2	What is the disadvantage of a ranch style house?
		4.1.3	Name four basic residential home designs.
		4.1.4	Why are dormers usually added to one and one-half story houses?
4.2	Identify and explain the the primary considerations for building a house, e.g., site community, cost and restrictions, zoning and codes, topographical features, family needs, detail plans working drawings.	4.2.1	List ten primary considerations for building a house.
		4.2.2	Explain why zoning and building codes should be investigated before building a house in a specific areas.
		4.2.3	List the type of drawings usually included in a complete set of drawings for residential construction.

Grade Level: 10-12

Skills/Subject Area: Architectural Drawing and Planning

COMPETENCY GOAL 4: The learner will describe house styles and a variety of considerations in planning a house.

Objectives	Measures
4.3 List the basic considerations in planning the sleeping area, living area, service area.	4.3.1 Explain the bathroom considerations—location and access for the sleeping area.
	4.3.2 What percent of the floor space of a typical house is the living area?
	4.3.3 Explain the difference between a den and a living room.
	4.3.4 The kitchen is usually classified as: a. a service area b. a living area
4.4 Lay out six types of kitchen designs.	4.4.1 Name six types of kitchen design.
	4.4.2 Explain the work triangle and give the suggested maximum measurement.
	4.4.3 Make a sketch of a kitchen on ¼-grid graph paper. Show base and wall cabinets.
4.5 Lay out a bathroom on a floor plan using good design techniques.	4.5.1 What is the standard size of a bathtub?
	4.5.2 Explain why it is poor design to plan a light switch close to the bathtub.
	4.5.3 Lay out a bathroom on ¼-grid graph paper. Show correct space for tub, water closet, door openings, and walk space.

VOCATIONAL EDUCATION
INDUSTRIAL ARTS EDUCATION

Grade Level: 10-12 Skills/Subject Area: Architectural Drawing and Planning

COMPETENCY GOAL 5: The learner will describe the use of different lines in architectural plans.

Objectives	Measures
5.1 Identify and use accurately the alphabet of lines.	5.5.1 Make the following lines: a. border line b. object line c. cutting plane line d. short break line e. long break line f. hidden line g. solid bold line h. center line i. section line j. dimenion line k. guide line l. construction line m. leader line
5.2 Demonstrate acceptable lettering techniques.	5.2.1 Explain the use of guide lines when lettering.
	5.2.2 Make sample letters and numbers. Compare them with acceptable drafting quality.
	5.2.3 What size lettering is usually recommended for notes on a drawing: a. 1/8" b. 5/8".

VOCATIONAL EDUCATION
INDUSTRIAL ARTS EDUCATION

Grade Level: 10-12

Skills/Subject Area: Architectural Drawing and Planning

COMPETENCY GOAL 6: The learner will apply sketching techniques to architectural plans.

Objectives		Measures	
6.1	Draw a rough sketch of sleeping, living, and service areas.	6.1.1	Using ¼-grid graph paper, sketch a bedroom (corner room with two outside walls). Size to outside of walls 10' x 15'. Show location of windows. Make dotted line for possible location of bed. Show closet and indicate the direction of the bathroom.
6.2	Draw a two-point perspective drawing.	6.2.1	Sketch a 1" square and complete a pictoral sketch representing a cube by the two-point perspective method.
		6.2.2	Make a sketch to represent a block of wood 2"X4"X6" in length. Make four separate sketches with the block in four different positions (i.e., flat, upright).
6.3	Demonstrate good sketching techniques.	6.3.1	Evaluation of student's work by instructor.

Grade Level: 10-12

Skills/Subject Area: Architectural Drawing and Planning

COMPETENCY GOAL 7: The learner will demonstrate the use of a plot plan in architectural planning.

Objectives	Measures
7.1 Describe the purpose and function of a plot plan.	7.1.1 Explain the purpose of contour lines on a plot plan.
	7.1.2 Explain why the city must have a plot plan before issuing a building permit.
	7.1.3 Sketch five topographical symbols used on plot plans.
7.2 Draw a plot plan.	7.2.1 Sketch a plot plan and show house location. Include contour lines, natural gas lines, sidewalk, paved driveway, and a small pond.
7.3 Draw basic roof designs and describe the advantages/disadvantages of each.	7.3.1 Sketch the plan view of a gable roof and a hip roof. Which roof would require the least custom cutting of the shingles?
	7.3.2 Sketch a T-shaped roof plan of a hip roof and label the ridge and the valleys.

Grade Level: 10-12

Skills/Subject Area: Architectural Drawing and Planning

COMPETENCY GOAL 7: The learner will demonstrate the use of a plot plan in architectural planning.

Objectives	Measures
7.4 Explain the purpose in basic plumbing considerations (e.g., water and waste removal, fixtures).	7.4.1 Explain the usual water supply for: a. city b. small town c. country
	7.4.2 Explain the usual waste removal for: a. city house b. country c. house
7.5 Draw a plumbing plan for a residence.	7.5.1 Answer True or False: In small homes, "the plumbing plan" and the location of fixtures are shown on the floor plan.
	7.5.2 Place a sheet of tracing paper over a floor plan and sketch in the plumbing plan.

VOCATIONAL EDUCATION
INDUSTRIAL ARTS EDUCATION

Grade Level: 10-12

Skills/Subject Area: Architectural Drawing and Planning

COMPETENCY GOAL 8: The learner will demonstrate the representation of building components and materials in an architectural drawing.

Objectives	Measures
8.1 Describe the functions of the following components of sill and floor construction: platform framing, balloon framing, joists and beams, subfloor, post and beam construction.	8.1.1 Make a sketch and show the differences between wall construction of balloon and platform construction.
	8.1.2 Sketch and/or explain the relationship between the subfloor and the finished floor.
8.2 List common sizes for sill and construction.	8.2.1 What are the three most common sizes of floor joist?
	8.2.2 Make a sketch of a built-up girder and show methods for supporting the floor joist.
8.3 Describe the following wall and ceiling construction components: frame wall construction, top plate, sole plate, stud.	8.3.1 What is the most common size of the vertical support members in the walls of a house?
	8.3.2 Make a sectional sketch and show: sill, header, sole plate, stud, double tap plate.
8.4 List the common names and sizes of brick.	8.4.1 What is the name and size of the most used brick?
8.5 Identify the common size of exterior and interior doors.	8.5.1 Give the size of the following doors: a. front b. inside room c. back or side service

Grade Level: 10-12

Skills/Subject Area: Architectural Drawing and Planning

COMPETENCY GOAL 8: The learner will demonstrate the representation of building components and materials in an architectural drawing.

Objectives	Measures
8.6 Identify the common types of exterior and interior doors.	8.6.1 Explain the differences between solid core, hollow core, and panel doors.
8.7 Identify the common types and sizes of windows available in construction.	8.7.1 Give advantages and disadvantages of the following windows: a. double hung b. casement c. awning.
	8.7.2 List three common window sizes.
8.8 Discuss the use of balusters, enclosed stairs, headroom, stringer, landing, newel, nosing, rise, run, riser.	8.8.1 Describe or sketch the following stair parts: a. newel b. baluster c. handrail d. headroom e. stringer f. rise g. run h. nosing i. tread j. riser

Skills/Subject Area: Architectural Drawing and Planning

COMPETENCY GOAL 8: The learner will demonstrate the representation of building components and materials in an architectural drawing.

Objectives	Measures
8.9 Identify electrical terms and symbols.	8.9.1 Sketch the following electrical symbols as used in a floor plan: a. duplex outlet b. ceiling outlet c. light switch d. weatherproof duplex outlet e. telephone f. recessed outlet fixtures g. three-way switch h. thermostat i. drop cord fixtures
8.10 List the factors that enter into figuring cost of financing.	8.10.1 What is the prime cost factor when borrowing money? 8.10.2 What are the factors a family should consider when making a decision as to how much they can pay for a house? 8.10.3 A general rule used by lending agencies is that the home should cost no more than ____ times the gross income of the family members.

Skills/Subject Area: Architectural Drawing and Planning

COMPETENCY GOAL 8: The learner will demonstrate the representation of building components and materials in an architectural drawing.

Objectives	Measures
8.11 List the information to be included in material specifications.	8.11.1 Write specifications (e.g., grade, quantity) for the following: a. plywood b. concrete c. brick d. gutters e. valley tin f. cabinet paint g. cabinet material h. type of glass i. thickness of sheet rock j. size of chimney flu k. grade of flooring l. type of asphalt shingles m. size of furnace n. size of air conditioner o. type of lintels

VOCATIONAL EDUCATION
INDUSTRIAL ARTS EDUCATION

Grade Level: 10-12

Skills/Subject Area: Architectural Drawing and Planning

COMPETENCY GOAL 9: The learner will demonstrate the use of elevations in architectural drawing.

Objectives	Measures
9.1 Describe the purpose and functions of elevation.	9.1.1 Which of the following drawings would best depict the structure as it appears from the outside a. floor plan b. section c. elevation 9.1.2 List features of a house that would be best shown in the front elevation.
9.2 List the information required to draw an elevation (e.g., grade lines, floors, ceilings, walls, windows, doors, roof features, dimensions, notes, symbols).	9.2.1 Make a rough elevation sketch of a small building (one room) and show: a. grade lines b. finish floor line c. ceiling line d. window height e. door height
9.3 Draw four elevation views properly.	9.3.1 Evaluation of student work by instructor.

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INDUSTRIAL ARTS EDUCATION

Grade Level: 10-12

Skills/Subject Area: Architectural Drawing and Planning

COMPETENCY GOAL 10: The learner will demonstrate the use of elevations in architectural drawing.

Objectives	Measures
10.1 Demonstrate geometric construction in architectural drawing.	10.1.1 Describe the equipment needed for making a geometric construction layout.
10.2 Calculate and figure roof pitch.	10.2.1 The pitch of a gable roof is 3" in 12". Calculate the height of the ridge if the house is 30' across.
10.3 Draw roof details.	10.3.1 Evaluation of student work by instructor.

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INDUSTRIAL ARTS EDUCATION

Grade Level: 10-12

Skills/Subject Area: Architectural Drawing and Planning

COMPETENCY GOAL 11: The learner will demonstrate the use of a foundation plan in architectural drawing.

Objectives	Measures
11.1 Describe the main characteristics of a footing in a foundation for a house.	11.1.1 Describe the type of materials used in a footing.
	11.1.2 Explain the differences between tensile strength and compression strength.
	11.1.3 The footing materials should have good: a. compression strength b. tensile strength
11.2 Describe the purpose and function of the foundation plan.	11.2.1 List the information that a builder could know from looking at the foundation plan.
	11.2.2 Make a sketch as found on a foundation plan to show a pier and a built up 2X2 girder.

Grade Level: 10-12 Page 2

Skills/Subject Area: Architectural Drawing and Planning

COMPETENCY GOAL 11: The learner will demonstrate the use of a foundation plan in architectural drawing.

Objectives	Measures
11.3 List the preliminary steps to drawing a foundation plan.	11.3.1 Answer True or False: The outline of the foundation has the same basic dimensions as the floor plan.
	11.3.2 Arrange the following steps in proper sequence: a. Show size and direction of floor joist b. Select the proper scale c. Draw the footings d. Draw the hidden lines for the footing e. Draw the hidden lines for the piers and column footing f. Draw in location of the vents
11.4 Draw a foundation using drawing instruments.	11.4.1 Evaluation of student work by the instructor.

Grade Level: 10-12 Page 3

Skills/Subject Area: Architectural Drawing and Planning

COMPETENCY GOAL 11: The learner will demonstrate the use of a foundation plan in architectural drawing.

Objectives	Measures
11.5 Define the following: platform framing, balloon framing, joists and beams, subfloor, post and beam construction.	11.5.1 Make a sketch (section through) to show platform framing. 11.5.2 Make a sketch (section through) to show balloon framing. 11.5.3 What is supported by the joists? 11.5.4 In a joist and beam construction: a. the beam supports the joist b. the joist supports the beams

VOCATIONAL EDUCATION
INDUSTRIAL ARTS EDUCATION

Grade Level: 10-12

Skills/Subject Area: Architectural Drawing and Planning

COMPETENCY GOAL 12: The learner will demonstrate the use of floor plans in architectural drawings.

Objectives	Measures
12.1 Identify basic considerations in planning sleeping area, living area, service area.	12.1.1 Explain the basic considerations in planning a sleeping area by giving the following information: amount of natural light, amount of natural ventilation, size of rooms, size of closet, bathroom needs, lighting, privacy, linen storage.
	12.1.2 Discuss the conversational area of a living room.
	12.1.3 Explain the planning considerations for a living room in terms of: natural light and ventilation, access, size.
	12.1.4 Describe the needs for the following service areas: food preparation, laundry, storage.
12.2 Identify common size exterior and interior door sizes.	12.2.1 Give the size of the following doors: a. front b. bedroom c. service d. bathroom
12.3 Identify common types and sizes of windows.	12.3.1 List four types of windows.
	12.3.2 List three common sizes of windows.
12.4 Describe the purpose and function of the floor plan.	12.4.1 List specific information that is given in the floor plan.

Grade Level: 10-12

Skills/Subject Area: Architectural Drawing and Planning

COMPETENCY GOAL 12: The learner will demonstrate the use of floor plans in architectural drawings.

Objectives	Measures
12.5 List information required for drawing a floor plan (e.g., size and location of windows, location and size of doors, cabinets, appliances and permanent fixtures, stairs and fireplace, walls, patios and decks, room names and material dimensions, dimensioning, scale and sheet identification).	12.5.1 Make a sketch of a floor plan and write in the following: a. size and location of doors and window b. location and size of fireplace c. location and width of stairs d. space for range and refrigerator e. placement and size of base and wall cabinets f. location of attic access g. size and location of stoops and decks
12.6 List the procedure for drawing floor plans.	12.6.1 Outline the procedure for making floor plan drawings and decks.
12.7 Develop an electrical plan for a residence.	12.7.1 Evaluation of student work by the instructor.
12.8 Draw a window, door, and lighting schedule.	12.8.1 Evaluation of student work by the instructor.

VOCATIONAL EDUCATION
INDUSTRIAL ARTS EDUCATION

Grade Level: 10-12

Skills/Subject Area: Architectural Drawing and Planning

COMPETENCY GOAL 13: The learner will demonstrate the treatment of fireplaces and chimneys in architectural drawings.

Objectives	Measures
13.1 Describe the function of a footing in a fireplace.	13.1.1 Explain why the footing for a fireplace should not be connected to the footing for the foundation wall.
	13.1.2 What is the purpose of the footing for the fireplace?
13.2 Identify common names and sizes of brick.	13.2.1 Name two types of brick used in foundation walls.
	13.2.2 What is the name and characteristics of the special type of brick used inside the fireplace?
13.3 Identify fireplace design considerations.	13.3.1 Give the rule about the chimney height.
	13.3.2 Use a chart and select the size of flue for a 30"X30" fireplace opening.
13.4 Draw a fireplace plan.	13.4.1 Make a sketch (section through) of a fireplace and show the following: fire brick, damper, smoke shelf, flue liner, hearth.
	13.4.2 Make a sketch of a fireplace as it would appear on the floor plan.

Grade Level: 10-12

Skills/Subject Area: Architectural Drawing and Planning

COMPETENCY GOAL 14: The learner will demonstrate the treatment of climate control systems in architectural drawings.

Objectives	Measures
14.1 List several climate control systems.	14.1.1 Describe a climate control system. 14.1.2 Name three types of heating systems. 14.1.3 Describe the operation of a heat pump.
14.2 Draw a plan for a climate control system (heating and air conditioning).	14.2.1 Evaluation of student work by the instructor.
14.3 Demonstrate a procedure for estimating a climate control system (heating and air conditioning).	14.3.1 Explain heat loss. 14.3.2 The resistivity of single strength glass is .88. What is its "R" value? (Formula: "R" value = Resistivity divided by 1). 14.3.3 Calculate the heat loss in BTU's per hour for a house. (Note: May be from student's plan.)

Basic Electricity/Electronics Technology Outline

1. Introduction

2. Careers Related to Electricity/Electronics

3. Knowledge of Science of Electronics

    a. Atomic theory
    b. Law of charge
    c. Electrical terms

4. Sources of Electricity

    a. Six sources of electricity
    b. Processes of obtaining electricity from six basic sources

5. Demonstrate Circuits and Power

    a. Ohm's Law
    b. Watt's Law
    c. Function of (resistance, voltage, and current)
    d. Series circuit
    e. Parallel circuits
    f. Series/parallel circuit

6. Laws of Magnetism

    a. Magnetism
    b. Solenoid
    c. Electromagnet

7. Applications of Law of Generators

    a. Faraday's experiment
    b. Lenz's Law
    c. Commutators
    d. Armatures
    e. Generators

8. Standard Symbols Used in Electrical or Electronic Industries

9. Inductance and RL Circuits

    a. Inductance
    b. Henry
    c. Transformer

10. Capacitance in Electronic Devices

11. Function of Electron Tubes in Electronic Devices

12. Power Supplies in Electronic Devices

    a. Purpose and function of power supply
    b. Purpose and function of half-wave rectification, full-wave rectification, filter
    c. Experiments demonstrating various functions of power supplies

13. Function of Solid State Devices in Electronic Circuits

    a. Diodes
    b. Transistors
    c. Resistors
    d. Integrated Devices

14. Digital Electronics in Electronic Industries

    a. Computer structure
    b. Digital logic gates
    c. Function of major section of the computer
    d. Binary system

15. Electronic Communication Systems

    a. Components of communication system
    b. Radio transmitters
    c. Radio receiver
    d. Communication system (microwave, laser, etc.)

16. Amplifiers in Electronic Systems

    a. Function of amplifier
    b. Experiments with Amplifier

17. Electrical Motors

18. Application of Electricity and Home Wiring System

    a. Significance of the colors of wires in home wiring system
    b. Switching

VOCATIONAL EDUCATION
INDUSTRIAL ARTS EDUCATION

Grade Level: 10-12

Skills/Subject Area: Basic Electricity/ Electronics Technology

COMPETENCY GOAL 1: The learner will identify the objectives of the industrial arts course, Electricity/Electronics.

Objectives	Measures
1.1 Describe the major objectives of the instructional program.	1.1.1 What are the major objectives of the industrial arts course, Electricity/Electronics?

VOCATIONAL EDUCATION
INDUSTRIAL ARTS EDUCATION

Grade Level: 10-12 Skills/Subject Area: Basic Electricity/ Electronics Technology

COMPETENCY GOAL 2: The learner will relate career information about electricity/ electronics to human knowledge, skills, abilities, and attitudes.

Objectives		Measures	
2.1	Identify personal interests, physical characteristics, aptitudes, and mental abilities.	2.1.1	Using the headings listed below, identify your unique strengths: a. personal interests b. physical characteristics c. aptitudes d. mental abilities
2.2	Identify possible career options consistent with abilities and aptitudes.	2.2.1	In the areas of electricity/electronics, list three possible careers that fit your abilities and aspirations.
2.3	Describe how value judgments affect lifestyles and career aspirations.	2.3.1	Explain how value judgments can affect your lifestyles and career aspirations.
2.4	Describe the relationship between attitude and success in life and work.	2.4.1	What is the relationship between attitude and success in life and work?
2.5	Describe the "transfer of skills" as it relates to tentative occupational goals.	2.5.1	Describe "transfer of skills" as it applies to tentative occupational goals.
2.6	Use decision-making processes in making occupational choices.	2.6.1	Choose an occupation and demonstrate how you use the decision-making process to determine if you should consider employment.
2.7	Identify educational and financial requirements for achieving tentative career goals.	2.7.1	Identify a tentative career goal and describe the educational and financial requirements.

Grade Level: 10-12

Skills/Subject Area: Basic Electricity/Electronics Technology

COMPETENCY GOAL 2: The learner will relate career information about electricity/electronics to human knowledge, skills, abilities, and attitudes.

Objectives	Measures
2.8 List a cluster of occupations.	2.8.1 Name a cluster of occupations in electricity/electronics.
2.9 Identify desirable employee traits and work habits (e.g., dependability, cooperation, pride in work).	2.9.1 List the desirable traits that an employer looks for.
2.10 List training opportunities at the high school, post-secondary, and college or university level.	2.10.1 Training opportunities to meet career goals are available at a. high school, b. post-secondary, c. college/university. Identify the types of jobs available as a result of each kind of training.

VOCATIONAL EDUCATION
INDUSTRIAL ARTS EDUCATION

Grade Level: 10-12

Skills/Subject Area: Basic Electricity/Electronics Technology

COMPETENCY GOAL 3: The learner will demonstrate knowledge of the science of electronics.

Objectives	Measures
3.1 Describe basic fundamentals of atomic theory (e.g., molecules, atoms, electrons, protons, neutrons).	3.1.1 Matter is composed of atoms. Make a sketch to show the placement of the following in the atomic structure: atoms, protons, neutrons, electrons.
	3.1.2 Explain the significance of valence electrons in the conduction of electricity.
	3.1.3 Explain the significance of the orbital level in the atomic structure of a material to the conduction of electrical current.
3.2 Explain the meaning of "law of charges."	3.2.1 State the "law of charges."

Skills/Subject Area: Basic Electricity/Electronics Technology

COMPETENCY GOAL 3: The learner will demonstrate knowledge of the science of electronics.

Objectives	Measures
3.3 Describe orally, or in writing, the meaning of the following: coulomb, electrostatic fields, current, voltage, conductors, insulators, resistance.	3.3.1 Match the following terms with their definitions: a. coulomb b. electrostatic field c. electrical current d. voltage e. conductor f. insulator g. resistance (1)_____measure of electrical movement in conductors. (2)_____measure of electrical pressure. (3)_____the effect of the accumulation. (4)_____the interference with the movement of electrons in a conductor which produces heat. (5)_____a substance or material which allows easy passage of electrons. (6)_____a substance or material which allows little or no passage of electron flow. (7)_____a quantitative measure of electron presence.

VOCATIONAL EDUCATION
INDUSTRIAL ARTS EDUCATION

Grade Level: 10-12 Skills/Subject Area: Basic Electricity/ Electroncis Technology

COMPETENCY GOAL 4: The learner will identify sources of electricity.

Objectives	Measures
4.1 Identify sources of electricity.	4.1.1 Name six sources of electron stimulation which cause electrical pressure (voltage).
	4.1.2 Give an application of six sources of electron stimulation which causes electrical pressure.
4.2 Describe the process of obtaining electricity from light, heat, mechanical pressure.	4.2.1 Teacher evaluation of verbal or written description.

VOCATIONAL EDUCATION
INDUSTRIAL ARTS EDUCATION

Grade Level: 10-12

Skills/Subject Area: Basic Electricity/
Electronics Technology

COMPETENCY GOAL 5: The learner will identify, describe, and demonstrate circuits and power.

Objectives	Measures
5.1 State Ohm's law three ways.	5.1.1 What is Ohm's law?
	5.1.2 Show three versions of the formula which mathematically represents the relationship of current, voltage, and resistance.
5.2 State Watt's law.	5.2.1 What is Watt's law?
	5.2.2 State the power relationship between current, volts, and resistance in three forms.
5.3 Describe the function of resistance, voltage, current.	5.3.1 In a circuit containing voltage from a source and resistance, what is the effect on current of in creasing the resistance? Of decreasing the resistance?
	5.3.2 If the current increases in a circuit and the resistance remains constant, what other variable has changed?
5.4 Identify factors that vary resistance.	5.4.1 In a copper conductor, name three factors that can alter resistance.
5.5 Compute amount of resistance, current, voltage, as defined in Ohm's law.	5.5.1 Teacher evaluation of student responses to math problems testing theories of Ohm's law.
5.6 Explain the way to visually determine the value of a resistor by color code.	5.6.1 Teacher evaluation of student responses to visual problems pertaining to resistor color codes.

Skills/Subject Area: Basic Electricity/Electronics Technology

COMPETENCY GOAL 5: The learner will identify, describe, and demonstrate circuits and power.

Competency Indicators		Competency Measures	
5.7	Construct a series circuit.	5.7.1	Teacher evaluation of student work.
5.8	Construct a parallel circuit.	5.8.1	Teacher evaluation of student work.
5.9	Construct a series/parallel circuit combined.	5.9.1	Teacher evaluation of student work.

VOCATIONAL EDUCATION
INDUSTRIAL ARTS EDUCATION

Grade Level: 10-12

Skills/Subject Area: Basic Electricity/ Electronics Technology

COMPETENCY GOAL 6: The learner will define and apply the laws of magnetism.

Objectives	Measures
6.1 Describe the laws of magnetism.	6.1.1 State the law of magnetic attraction.
6.2 Define purpose and function of a solenoid.	6.2.1 To what characteristics of magnetic lines of force is the pull on the core of a solenoid attributable?
	6.2.2 Name three applications of the use of solenoids in the house or shop.
6.3 Construct an electromagnet.	6.3.1 Teacher evaluation of student work.

Grade Level: 10-12 Skills/Subject Area: Basic Electricity/ Electronics Technology

COMPETENCY GOAL 7: The learner will define and describe applications of the laws of generators.

Objectives	Measures
7.1 Describe Faraday's Experiment.	7.1.1 What determines the voltage produced by the relative motion between a conductor and a magnet? 7.1.2 What determines the polarity of the voltage when there is relative motion between a conductor in a magnetic field?
7.2 Explain Lenz's Law.	7.2.1 What is the direction of inducted currents (as stated by Lenz) when induced in the secondary of a transformer?
7.3 Describe the purpose of commutators.	7.3.1 What is the purpose of commutators?
7.4 Identify the method of construction for cores of armatures.	7.4.1 Why are the cores of armatures and transformers laminated?
7.5 Name and describe three types of generators.	7.5.1 Name three types of generators. Draw a schematic of each.

VOCATIONAL EDUCATION
INDUSTRIAL ARTS EDUCATION

Grade Level: 10-12

Skills/Subject Area: Basic Electricity/ Electronics Technology

COMPETENCY GOAL 8: The learner will recognize standard symbols used in electrical or electronic industries.

Objectives	Measures
8.1 Identify the standard symbols for: ground, wires crossing not connected, resistor, potentiometer, fixed capacitor, variable capacitor, battery, switch SPST, switch SPDT, antenna.	8.1.1 Draw the symbols for the following: a. ground b. wires crossing not connected c. resistor d. potentiometer e. fixed capacitor f. variable capacitor g. battery h. switch SPST i. switch SPDT j. antenna

VOCATIONAL EDUCATION
INDUSTRIAL ARTS EDUCATION

Grade Level: 10-12

Skills/Subject Area: Basic Electricity/ Electronics Technology

COMPETENCY GOAL 9: The learner will explain the use of inductance and RL circuits in electronic devices.

Objectives		Measures	
9.1	Define "inductance."	9.1.1	Define in words the term "inductance."
9.2	Define "Henry."	9.2.1	The unit of measurement of inductance is the Henry. Define the term.
9.3	Explain the function of inductance in electricity/electronics.	9.3.1	Name two examples of the use of inductors in electrical appliances or equipment.
9.4	Name three uses of transformers.	9.4.1	Name three uses of transformers.

Grade Level: 10-12 Skills/Subject Area: Basic Electricity/ Electronics Technology

COMPETENCY GOAL 10: The learner will explain the use of capacitance in electronic devices.

Objectives	Measures
10.1 Define capacitance in an electrical circuit.	10.1.1 Define capacitance. 10.1.2 What is the physical make-up of a capacitor?
10.2 Describe the factors that determine increases and decreases in a capacitor.	10.2.1 What are the factors which determine the capacitance of a capacitor? 10.2.2 What is the effect of connecting two capacitors in series? in parallel?
10.3 Name seven types of capacitors and identify where they are used.	10.3.1 Name several types of capacitors and indicate their general use.

VOCATIONAL EDUCATION
INDUSTRIAL ARTS EDUCATION

Grade Level: 10-12

Skills/Subject Area: Basic Electricity/
Electronics Technology

COMPETENCY GOAL 11: The learner will explain the function of electron tubes in electronic devices.

Objectives	Measures
11.1 Describe the purpose and function of the electron tube in electricity/electronics.	11.1.1 Name three ways in which electron tubes can be used in electronic devices.
11.2 Define and describe the following: cathode, diode, triode, tetrode, pentode.	11.2.1 The terms diode, triode, tetrode, and pentode refer to electron tubes. Define the terminology used as to its relevance to electronic devices.
	11.2.2 What is the function of the following components of an electron tube? a. cathode b. plate or anode c. heater d. grid e. screen grid

VOCATIONAL EDUCATION
INDUSTRIAL ARTS EDUCATION

Grade Level: 10-12

Skills/Subject Area: Basic Electricity/
Electronics Technology

COMPETENCY GOAL 12: The learner will explain the function of power supply in electronic devices.

Objectives	Measures
12.1 Identify the purposes and functions of power supply.	12.1.1 List the typical stages in a power supply for use with AC equipment where the source is 117V AC house current. Give the functions of each stage.
12.2 Define the purpose and function of "half-wave rectification," "full-wave rectification," and "filters."	12.2.1 Draw a schematic of a half-wave rectifier circuit. Show the wave-form at each point in the schematic.
	12.2.2 Draw a schematic of a full-wave rectifier circuit (using a transformer). Show the wave-form at each point in the schematic.
	12.2.3 Draw a type filter circuit for a full-wave rectifier. Draw the wave-form at each point in the filter.
12.3 Simulate experiments that demonstrate various functions of power supplies.	12.3.1 Teacher evaluation of student work.
12.4 Describe the function of the vacuum tube as an oscillator.	12.4.1 Electron tubes and transistors are used in electronic oscillators. What are the requirements for an oscillator to continue to operate at a given frequency?

VOCATIONAL EDUCATION
INDUSTRIAL ARTS EDUCATION

Grade Level: 10-12 Skills/Subject Area: Basic Electricity/
Electronics Technology

COMPETENCY GOAL 13: The learner will explain the function of transistors in electronic devices.

Objectives	Measures
13.1 Describe the purpose and function of the transistor.	13.1.1 Name several applications of transistors.
13.2 Define the basic structure of the transistor.	13.2.1 What is meant by "p" type material and "n" type material?
	13.2.2 What does the term transistor mean? What does junction mean when applied to transistors?
13.3 Identify the industrial applications of electronics.	13.3.1 Name several industrial uses of transistors.
13.4 Explain the difference between the two basic types of junction transistors.	13.4.1 What is the most common type of transistor function in use in manufactured products?
13.5 Name the three transistor elements.	13.5.1 What are the elements in a transistor?
13.6 Describe the function of integrated circuits.	13.6.1 Describe what is meant by an integrated circuit.
13.7 Draw a block diagram of a common integrated circuit.	13.7.1 Teacher evaluation of student work.

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INDUSTRIAL ARTS EDUCATION

Grade Level: 10-12

Skills/Subject Area: Basic Electricity/ Electronics Technology

COMPETENCY GOAL 14: The learner will explain digital electronics in the electronics industries.

Objectives	Measures
14.1 Name and describe the major sections of a computer.	14.1.1 Name the major sections of a computer.
14.2 Name the major types of digital logic gates.	14.2.1 Name five types of digital logic gates.
14.3 Explain the function of the major sections of a computer.	14.3.1 Briefly describe the function of the major sections of a computer.
14.4 Explain the function of logic gates.	14.4.1 List three types of logic gates and briefly tell what each gate performs.
14.5 List several applications of digital electronic systems.	14.5.1 List several common products using digital electronic systems.
14.6 Identify the relationship of digital electronic systems and the binary number system.	14.6.1 What is the relationship of the binary number system to digital electronic systems?

VOCATIONAL EDUCATION
INDUSTRIAL ARTS EDUCATION

Grade Level: 10-12

Skills/Subject Area: Basic Electricity/ Electronics Technology

COMPETENCY GOAL 15: The learner will describe electronic communications systems.

Objectives	Measures
15.1 Name the two major components which make up a communications system.	15.1.1 Name the two major components that make up an electronic communications system.
15.2 Draw a simplified block diagram of a radio transmitter.	15.2.1 Teacher evaluation of student work.
15.3 Draw a simplified block diagram of a radio receiver.	15.3.1 Teacher evaluation of student work.
15.4 Explain the function of modulation systems.	15.4.1 How is sound converted to a radio signal in: a. AM radio b. FM radio?
15.5 Explain the function of the major sections of a radio transmitter.	15.5.1 Draw a block diagram of an AM transmitter and indicate the function(s) performed at each stage.
15.6 Explain the function of the major sections of a radio receiver.	15.6.1 Draw a block diagram of an AM radio receiver and indicate the function(s) performed at each block.
15.7 Describe the purpose of transmitting and receiving antennas.	15.7.1 Describe how radio waves are put into and taken out of the space between transmitter and receiver. 15.7.2 Explain the reason antennas differ in physical size.

Grade Level: 10-12 Page 2

Skills/Subject Area: Basic Electricity/Electronics Technology

COMPETENCY GOAL 15: The learner will describe electronic communications systems.

Objectives	Measures
15.8 Describe several communications systems (e.g., microwave, laser).	15.8.1 Describe the following communications systems and give an application of each: a. microwave b. laser

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Grade Level: 10-12

Skills/Subject Area: Basic Electricity/Electronics Technology

COMPETENCY GOAL 16: The learner will describe electronics control systems.

Objectives	Measures
16.1 Draw a simplified block diagram of an electronic control system.	16.1.1 Teacher evaluation of student work.
16.2 Explain the function of transducers in electronic control systems.	16.2.1 What does the term "transducer" mean?
16.3 List at least three transducer devices.	16.3.1 Identify three transducer devices and explain the function of each.
16.4 Name at least four applications of electronic control systems.	16.4.1 List four applications in which electronic control systems are used in military and/or manufacturing operations.

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INDUSTRIAL ARTS EDUCATION

Grade Level: 10-12

Skills/Subject Area: Basic Electricity/Electronics Technology

COMPETENCY GOAL 17: The learner will explain the use of amplifiers in electronic systems.

Objectives	Measures
17.1 Identify the function of an amplifier.	17.1.1 Draw a block diagram of a simple one-stage amplifier.
	17.1.2 Explain how gain is computed for an amplifier.
17.2 Perform experiments which demonstrate the function of amplifiers.	17.2.1 Teacher evaluation of student work.
17.3 List several applications of amplifiers in electronic communications, digital systems, and control systems.	17.3.1 Name at least five applications of the use of electronic amplifiers.

VOCATIONAL EDUCATION
INDUSTRIAL ARTS EDUCATION

Grade Level: 10-12

Skills/Subject Area: Basic Electricity/ Electronics Technology

COMPETENCY GOAL 18: The learner will describe the use of electrical motors.

Objectives	Measures
18.1 Identify the most commonly used motors in a home.	18.1.1 Identify the types of motors most appropriate for: a. small loads (e.g., fans, small toys). b. small hand tools c. clocks
	18.1.2 What type of motor can run faster than 3600 RPM on house current?
	18.1.3 What type of motor can have its speed controlled by varying the voltage?

VOCATIONAL EDUCATION
INDUSTRIAL ARTS EDUCATION

Grade Level: 10-12

Skills/Subject Area: Basic Electricity/
Electronics Technology

COMPETENCY GOAL 19: The learner will explain the application of electricity to home wiring systems.

Objectives	Measures
19.1 Identify the significance of the colors of wire in a home wiring system.	19.1.1 The neutral (ground) in the wiring system is (always, sometimes, never) white or uncolored.
	19.1.2 The switch in a light circuit interrupts the (neutral, "hot" wire) in a switching circuit.
19.2 Identify the ways in which switching is accomplished.	

Communications Technology Outline

1. Introduction to Communication Technology

2. Career Information About Visual, Graphic, and Electronic Communication

3. Definition of Communications

    a. Encoding
    b. Transmitting
    c. Receiving
    d. Decoding
    e. Storing
    f. Retrieving

4. Systems of Communication

    a. People to people
    b. Human to machine
    c. Machine to machine

5. Shannon Communications Model

    a. Define the Shannon Communications Model
    b. Comparison of human communications to machine communication
    c. Methods of transmitting a message
    d. Three channels and effects of noises on each
    e. Electronic receiver vs. nonelectronic receiver

6. Visual Communication (Drawing) and the Communication Model

7. Mechanical Aids for Producing Accurate Visual Interpretation

    a. Basic sketching fundamentals
    b. Sketching techniques
    c. Sketching multiview and pictorial drawing
    d. Drawing instruments

8. Constructing Geometric Figures

9. Precision Drawings in the Visual Communication Process

    a. Multiview drawing
    b. Basic symbols and rules for dimensioning
    c. Shape and size
    d. Proper dimensioning techniques
    e. Isometric, oblique, and perspective pictorial drawing
    f. Auxiliary view

10. Graphic Communications to Shannon Communications Model

11. Letterpress Printing

    a. Letterpress procedures
    b. Methods of figuring paper
    c. Operation of paper cutter

12. Principles of Bookbinding

13. Screen Printing Technique

    a. Hand cut stencils
    b. Photographic silk-screen printing process

14. Scientific Principle and Operation of Lithography

15. Relationship of Electronic Communication to the Shannon Communication Model

16. Basic Electronic Processes

    a. Power supplies
    b. Amplifier
    c. Oscillator

17. Operating Principles of One-Way Communications Systems

    a. Radio
    b. Phonograph
    c. Television
    d. Tape Recorder

18. Two-Way Communication System

    a. Telegraph
    b. Telephone
    c. Radar
    d. Satellites
    e. Computers

19. Electronic Communications Storage Devices

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INDUSTRIAL ARTS EDUCATION

Grade Level: 9-12 Skills/Subject Area: Communications Technology

COMPETENCY GOAL 1: The learner will identify objectives of an industrial arts course in communications technology.

Objectives	Measures
1.1 Describe the major objectives of the instructional program.	1.1.1 List the objectives of the industrial arts course, Communications Technology?

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INDUSTRIAL ARTS EDUCATION

Grade Level: 9-12 Skills/Subject Area: Communications Technology

COMPETENCY GOAL 2: The learner will relate career information about visual, graphic, and electronic communications with human knowledge, skills, abilities and attitudes.

Objectives	Measures
2.1 Identify personal interests, physical characteristics, aptitudes and mental abilities.	2.1.1 Using the headings listed below, identify her/his unique strengths: a. personal interests b. physical characteristics c. aptitudes d. mental abilities
2.2 Identify possible career options consistent with abilities and aptitudes.	2.2.1 List three careers in communications that fit her/his abilities and aspirations.
2.3 Describe how value judgments affect lifestyles and career aspirations.	2.3.1 Explain how value judgements can affect her/his lifestyle and career aspirations.
2.4 Describe relationship between attitude and success in life work.	2.4.1 Describe the relationship between attitude and success in life and work.
2.5 Describe the "transfer of skill" as it relates to tentative occupational career goals.	2.5.1 Describe "transfer of skill" as it applies to tentative occupational career goals.
2.6 Use decision-making processes in making occupational choices.	2.6.1 Choose a communications occupation and demonstrate how to use the decision-making process.

Skills/Subject Area: Communications Technology

COMPETENCY GOAL 2: The learner will relate career information about visual, graphic, and electronic communications with human knowledge, skills, abilities and attitudes.

Objectives		Measures	
2.7	Identify educational and financial requirements for achieving tentative career goals.	2.7.1	Identify a tentative career goal and describe the education and financial requirements.
2.8	List a cluster of occupations.	2.8.1	Name a cluster of occupations in communications.
2.9	Identify desirable employee traits and work habits (e.g., dependability, cooperation, pride in work).	2.9.1	List the traits of a good employee.
2.10	List training opportunities at the high school, post-secondary, and college or university level.	2.10.1	Identify the types of jobs s/he might expect as a result of: a. high school training b. post-secondary training c. college/university training

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INDUSTRIAL ARTS EDUCATION

Grade Level: 9-12 Skills/Subject Area: Communications Technology

COMPETENCY GOAL 3: The learner will describe communications.

Objectives		Measures	
3.1	Define communications using the terms encoding, transmitting, receiving, decoding, storing, and retrieving.	3.1.1	Define the term "communication."
		3.1.2	Define the following communications terms: encoding, transmitting, receiving, decoding, storing, and retrieving.

Grade Level: 9-12 Skills/Subject Area: Communications Technology

COMPETENCY GOAL 4: The learner will describe systems of communications.

Objectives	Measures
4.1 List three combinations of ways in which communications take place.	4.1.1 Discuss ways in which people communicate with people.
	4.1.2 Discuss ways in which humans and machines communicate with each other.
	4.1.3 Discuss ways in which machines communicate with each other.

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Grade Level: 9-12   Skills/Subject Area: Communications Technology

COMPETENCY GOAL 5: The learner will identify the major components of a communications model.

Objectives	Measures
5.1 Identify and define the Shannon Communications Model.	5.1.1 Draw the Shannon Communications Model.
5.2 Compare and contrast the human with a machine information source.	5.2.1 Discuss the similarities and differences between human and machines as information sources.
5.3 Identity four methods of transmitting a message.	5.3.1 Identify the most effective methods of transmitting a message to: a. another person b. entire school c. community d. state
5.4 Identify three channels and explain the effect noise may have on each.	5.4.1 Demonstrate the use of three channels and the effect noise have on each channel.
5.5 Compare electronic receivers with nonelectronic receivers.	5.5.1 Compare the function of human eyes and ears to that of radio and television.

Grade Level: 9-12   Skills/Subject Area: Communications Technology

COMPETENCY GOAL 6: The learner will identify the relationship of visual communications (drawing) to the communications model.

Objectives		Measures	
6.1	Diagram the Shannon Communications Model and show the placement of drawing within the model.	6.1.1	Draw a diagram of a communications mode. Show where drawing fits in the model.

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Grade Level: 9-12 Skills/Subject Area: Communications Technology

COMPETENCY GOAL 7: The learner will demonstrate the use of mechanical aids in producing accurate visual interpretation.

Objectives	Measures
7.1 Identify basic sketching fundamentals: lines, symbols, arcs, circles, multiviews, pictorial.	7.1.1 List three characteristics which describe the nature of a sketch.
7.2 Demonstrate acceptable sketching techniques.	7.2.1 Sketch the alphabet of lines. Then sketch the following: a. circle b. ellipse c. square d. ellipse in isometric
7.3 Sketch a multiview and pictorial drawing.	7.3.1 Provide examples of work for evaluation.

VOCATIONAL EDUCATION
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Grade Level: 9-12 Skills/Subject Area: Communications Technology

COMPETENCY GOAL 8: The learner will demonstrate the use of mechanical aids in producing accurate visual interpretations.

Objectives	Measures
8.1 Identify and use drawing instruments (i.e., T-square, triangles, pencils, compass).	8.1.1 Answer the following questions: a. What is the purpose of the T-square? b. Name two kinds of triangles. c. Drafting pencils have 17 degrees of hardness. List the range from soft to hard. d. What is the purpose of a compass? e. What is the purpose of a scale?

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INDUSTRIAL ARTS

Grade Level: 9-12 Skills/Subject Area: Communications Technology

COMPETENCY GOAL 9: The learner will accurately construct geometric figures.

Objectives	Measures
9.1 Perform basic geometric construction skills (e.g., lines, angles, squares, polygons, tangents, ellipses).	9.1.1 Use proper techniques and instruments to do the following geometric constructions: a. bisect line AB. A B b. construct a perpendicular P. P c. construct a square within a circle, with corners touching the circle. d. construct a regular hexagon around a circle. e. construct an isosceles triangle at base AB with sides equal to CD. A B C D

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INDUSTRIAL ARTS EDUCATION

Grade Level: 9-12 Skills/Subject Area: Communications Technology

COMPETENCY GOAL 10: The learner will describe and illustrate practical application of precision drawings in the visual communications process.

Objectives	Measures
10.1 Identify and describe the main views in multiview drawing.	10.1.1 Name the main views in an orthographic drawing.
10.2 Execute multiview drawings.	10.2.1 Provide examples of work for teacher evaluation.
10.3 Identify basic symbols and and rules for dimensioning.	10.3.1 List six rules for dimensioning.
10.4 Define shape and size description.	10.4.1 Define each of the following terms: a. alphabet of lines b. leaders c. object lines d. extension line e. scale
10.5 Use proper dimensioning techniques.	10.5.1 Provide examples of work for teacher evaluation.
10.6 Draw isometric, oblique, and perspective pictorial drawings.	10.6.1 Provide examples of work for teacher evaluation.
10.7 Define purpose of a sectional view.	10.7.1 Describe the purposes of the following sectional views? a. full-section b. half-section c. cutting plane lines d. broken-out section

Skills/Subject Area: Communications Technology

COMPETENCY GOAL 10: The learner will describe and illustrate practical application of precision drawings in the visual communications process.

Objectives	Measures
10.8 Identify basic techniques used in sectioning.	10.8.1 Name instruments used in making sectionals?
10.9 Draw a full and half-section.	10.9.1 Provide examples of work for teacher evaluation.
10.10 Define purpose of an auxiliary.	10.10.1 Explain the reasons for drawing auxiliary views.
10.11 Draw an auxiliary view.	10.11.1 Provide examples of work for teacher evaluation.

Grade Level: 9-12 Skills/Subject Area: Communications Technology

COMPETENCY GOAL 11: The learner will identify the relationship of graphic communications to the Shannon Communications Model.

Objectives	Measures
11.1 Diagram the Shannon Communications Model and show the placement of graphic communications within the model.	11.1.1 Draw a diagram of a communica-model. Show where graphic communications fits in the model.

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Grade Level: 9-12 Skills/Subject Area: Communications Technology

COMPETENCY GOAL 12: The learner will describe letterpress printing as a part of the graphic arts industry and demonstrate concepts of letterpress printing.

Objectives	Measures
12.1 Identify the educational needs and occupational opportunities of the letterpress printer.	12.1.1 Describe occupational opportunities for a letterpress printer.
12.2 Describe the basic letterpress procedure.	12.2.1 List steps in producing a letterpress product.
12.3 Describe the correct procedure for operating a power platen press.	12.3.1 List steps in operating a power platen press.
	12.3.2 List safety rules in operating a power platen press.
12.4 Describe the basic methods of using relief type to manufacture a rubber stamp.	12.4.1 List steps in the manufacture of a rubber stamp.
12.5 Produce a letterpress project.	12.5.1 Provide examples of work for teacher evaluation.

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INDUSTRIAL ARTS EDUCATION

Grade Level: 9-12 Skills/Subject Area: Communications Technology

COMPETENCY GOAL 13: The learner will demonstrate mathematical and operational procedures in paper utilization.

Objectives	Measures
13.1 Identify several methods of figuring paper needs for selected jobs.	13.1.1 Use two methods to figure paper needs for the following job: 500 sheets - 8½" X 11" from sheet size 22" X 28".
13.2 Describe the proper operation of the paper cutter.	13.2.1 List steps in operating a paper cutter.
	13.2.2 List safety rules in operating a paper cutter.

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Grade Level: 9-12 Skills/Subject Area: Communications Technology

COMPETENCY GOAL 14: The learner will demonstrate the principles of bookbinding.

Objectives	Measures
14.1 Describe the procedure of bookbinding.	14.1.1 Describe the process of binding a book.
14.2 Demonstrate a binding method.	14.2.1 Provide examples of work for teacher evaluation.

Grade Level: 9-12 Skills/Subject Area: Communications Technology

COMPETENCY GOAL 15: The learner will demonstrate the concepts of screen process printing.

Objectives	Measures
15.1 Describe hand cut stencil procedure.	15.1.1 List steps in producing a hand cut stencil.
15.2 Describe photographic silk screen printing process.	15.2.1 Describe two types of photographic screens--direct emulsion, photographic transfer film.
15.3 Produce a screen print.	15.3.1 Provide examples of work for teacher evaluation.

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Grade Level: 9-12 Skills/Subject Area: Communications Technology

COMPETENCY GOAL 16: The learner will demonstrate scientific principles and operational procedures that affect lithography.

Objectives	Measures
16.1 Describe the method of producing non-photographic negatives.	16.1.1 Explain the production of non-photographic negative.
16.2 Describe the importance of design in communication and printing.	16.2.1 Why is design important to communication and printing?
16.3 Describe methods of preparing camera-ready layouts.	16.3.1 Describe a method of preparing camera ready layouts.
16.4 Identify the principles and mechanics of line photography.	16.4.1 What are the principles of line photography?
16.5 Demonstrate the correct procedure for operating an industrial camera.	16.5.1 List the steps in operating an industrial camera.
16.6 Describe proper procedure for handling, exposing, developing, and fixing film.	16.6.1 List the proper steps for each: a. handling film b. exposing film c. developing film d. fixing film

Grade Level: 9-12

Skills/Subject Area: Communications Technology

COMPETENCY GOAL 16: The learner will demonstrate scientific principles and operational procedures that affect lithography.

Objectives	Measures
16.7 Describe stripping and opaqueing process.	16.7.1 List the steps in stripping and opaqueing a photographic negative.
	16.7.2 Define the terms: a. stripping b. opaqueing
16.8 Demonstrate the plate making procedure.	16.8.1 Provide examples of work for teacher evaluation.

Grade Level: 9-12 Skills/Subject Area: Communications Technology

COMPETENCY GOAL 17: The learner will identify the relationship of electronic communication to the Shannon Communications Model.

Objectives	Measures
17.1 Diagram the Shannon Communications Model and show the placement of electronic communications within the model.	17.1.1 Draw a diagram of a communications model. Show where electronic communications fit in the model.

Grade Level: 9-12 Skills/Subject Area: Communications Technology

COMPETENCY GOAL 18: The learner will identify and describe the purposes of basic electronic processes.

Objectives	Measures
18.1 Describe and demonstrate basic operation and use of a power supply.	18.1.1 Explain is the purpose of a power supply.
	18.1.2 Identify the purposes of the following components of a power supply: a. transformer b. rectifier c. filter d. voltage regulator
	18.1.3 Provide a bread board of a power supply for teacher evaluation.
18.2 Describe and demonstrate the basic principles of an amplifier.	18.2.1 Explain the purpose of an amplifier.
	18.2.2 Identify two devices that amplify. Draw a diagram of the basic circuits.
	18.2.3 Provide a bread board of an amplifier connected to the power supply for teacher evaluation.

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Skills/Subject Area: Communications Technology

COMPETENCY GOAL 18: The learner will identify and describe the purposes of basic electronic processes.

Objectives	Measures
18.4 Describe and demonstrate the basic principles of an oscillator.	18.4.1 Identify basic principles involved in switching.
	18.4.2 Illustrate how each of the following gate circuits work: a. and gate b. or gate c. and gate d. nor gate
	18.4.3 List several uses of integrated circuits.
	18.4.4 Discuss how logic is introduced into a circuit.

Grade Level: 9-12 Skills/Subject Area: Communications Technology

COMPETENCY GOAL 19: The learner will identify and discuss the operating principles of one-way communications systems.

Objectives	Measures
19.1 Discuss and demonstrate the operational principles of a radio.	19.1.1 Describe how transmitters operate and the types of communication signals that they radiate.
	19.1.2 List the functions of antennas.
	19.1.3 List the differences between a a crystal radio and a super heterodyne radio.
	19.1.4 Explain the term, TFR receiver.
19.2 Discuss and demonstrate the operational principles of a phonograph.	19.2.1 Describe how a phonograph operates.
	19.2.2 List the steps needed in making a recording.
	19.2.3 Identify the purposes of each: a. cartridge b. amplifier
	19.2.4 Diagram a speaker. Name the parts and describe their functions.
	19.2.5 Compare and contrast a hi-fi to a stereo system.
	19.2.6 Provide examples of work for teacher evaluation.

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Skills/Subject Area: Communications Technology

COMPETENCY GOAL 19: The learner will identify and discuss the operating principles of one-way communications systems.

Objectives	Measures
19.3 Discuss and demonstrate the operational principles of television.	19.3.1 Explain how a TV operates.
	19.3.2 Explain how light and sound are converted to electrical images in TV cameras.
	19.3.3 Discuss the likeness and differences in video components between a black and white and color TV.
	19.3.4 Provide a student-produced video tape for teacher evaluation.
19.4 Discuss and demonstrate the operational principles of a tape recorder.	19.4.1 Explain how sound is connected into electrical signals, i.e. how intelligence can be recorded on tape.
	19.4.2 Demonstrate the following: a. how a tape recorder works b. how to care for a tape recorder
	19.4.3 List the advantages and disadvantages of a tape recorder over a phonograph.

Grade Level: 9-12 Skills/Subject Area: Communications Technology

COMPETENCY GOAL 20: The learner will identify and discuss the operating principles of two-way communication systems.

Objectives	Measures
20.1 Discuss the significance of the telegraph and demonstrate its operational principles.	20.1.1 Explain the importance of the telegraph in early communications.
	20.1.2 List the basic principles of operation of the telegraph.
	20.1.3 Describe the Morse and binary codes.
	20.1.4 Send and receive a telegraph message on a simple telegraph machine constructed by the student.
20.2 Discuss the significance of the telephone and describe its operational principles.	20.2.1 Explain the importance of the telephone in communications.
	20.2.2 Describe the basic operational principle of the telephone.
	20.2.3 Describe the operation of a modern telephone system.
20.3 Discuss the basic operational principle of radar.	20.3.1 Explain the echo principle.
	20.3.2 List the ways in which radar is used by the military and by civilians.

Grade Level: 9-12

Skills/Subject Area: Communications Technology

COMPETENCY GOAL 20: The learner will identify and discuss the operating principles of two-way communication systems.

Objectives	Measures
20.4 Discuss the use of satellites in communications.	20.4.1 Discuss the various uses of satellites in communications.
	20.4.2 Describe the differences between rotating and fixed satellites.
	20.4.3 Explain the use of a satellite as a relay station.
20.5 Discuss the use of computers in communications.	20.5.1 Describe how people communicate with machines.
	20.5.2 List some ways in which machines communicate with people.
	20.5.3 Identify the following basic functions of a computer: a. input devices b. process and storage devices c. why computers do a better job than people on certain things.
	20.5.4 Provide a demonstration of the computer as a tool to assist in problem-solving.
20.6 Discuss the use of tape recordings in communications.	20.6.1 Explain the use of tape recordings in one and two-way communications.
	20.6.2 Name a common use of tape recordings in the home or office setting.

VOCATIONAL EDUCATION
INDUSTRIAL ARTS EDUCATION

Grade Level: 9-12 Skills/Subject Area: Communications Technology

COMPETENCY GOAL 21: The learner will describe electronic communications storage devices.

Objectives	Measures
21.1 Discuss the use of disk storage in machine-to-machine communications.	21.1.1 Explain how a disk drive operates in machine-to-machine communication.
	21.1.2 Describe the differences between the floppy disk and magnetic tape used in cassettes.
	21.1.3 Describe how a hard disk storage system operates.
	21.1.4 Explain how the layer disk operates.

Construction Technology Outline

1. Introduction to Construction Technology

2. Career Information within Construction Technology

3. Define the Construction Technology System

4. Element Involved in Preparation of Construction Projects

5. Site and Foundation Preparation/Construction

   a. Cleaning and grading the site
   b. Foundation types

6. Construction Superstructure

7. Installation of Utilities

   a. Define utilities
   b. Plumbing systems
   c. Electrical
   d. Emerging alternative energy sources

8. Structure Enclosures

9. Interior Finishing

10. Management Within Construction Technology

11. Concepts of Marketing and Real Estate Within Construction Technology

VOCATIONAL EDUCATION
INDUSTRIAL ARTS EDUCATION

Grade Level: 9-12 Skills/Subject Area: Construction Technology

COMPETENCY GOAL 1: The learner will describe the purpose and objectives of an industrial arts course in Construction Technology.

Objectives	Measures
1.1 Describe the major objectives of the instructional program.	Refer to Competency/Test Item Book VEC-IAE-C/TIB 8140, p. 5.

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INDUSTRIAL ARTS EDUCATION

Grade Level: 9-12 Skills/Subject Area: Construction Technology

COMPETENCY GOAL 2: The learner will relate career information about contruction with human knowledge, skills, abilities, and attitudes.

Objectives	Measures
2.1 Identify personal interests, physical characteristics, aptitudes, and mental abilities.	Refer to Competency/Test Item Book VEC-IAE-C/TIB 8140, pp. 6-17.
2.2 Identify possible career options consistent with abilities and aptitudes.	
2.3 Describe how value judgements affect lifestyles and career aspirations.	
2.4 Describe relationship between attitude and success in life and work.	
2.5 Describe the "transfer of skill" as it relates to tentative occupational career goals.	
2.6 Use decision-making processes in making occupational choices.	
2.7 Identify education and financial requirements for achieving tentative career goals.	
2.8 List a cluster of occupations.	

Grade Level: 9-12 Page 2

Skills/Subject Area: Construction Technology

COMPETENCY GOAL 2: The learner will relate career information about construction with human knowledge, skills, abilities, and attitudes.

Objectives	Measures
2.9 Identify desirable employee traits and work habits (e.g., dependability, cooperation, pride in work).	
2.10 List training opportunities at the high school, post-secondary, and college or university level.	

VOCATIONAL EDUCATION
INDUSTRIAL ARTS EDUCATION

Grade Level: 9-12　　　Skills/Subject Area: Construction Technology

COMPETENCY GOAL 3: The learner will define the technological system of construction in terms of human and social needs and identify common elements of any construction project.

Objectives	Measures
3.1 Define construction technology. a. Describe how the construction industry meets human needs. b. Recognize and describe the impact of the construction industry on the development of communities.	Refer to Competency/Test Item Book VEC-IAE-C/TIB 8140, pp. 18-26.
3.2 Identify and define the elements needed to plan and build a construction project. a. Describe and perform the management skills of planning, organizing, and controlling.	

Grade Level: 9-12 Skills/Subject Area: Construction Technology

COMPETENCY GOAL 4: The learner will identify and describe the various elements involved in preparation for a construction project.

Objectives	Measures
4.1 Identify the importance of the following factors in community planning (e.g., utilities, transportation, housing, business, school and recreation, and zoning). a. Describe the importance of utilities to a community. b. Identify utilities necessary in a community. c. Identify utility site requirements. d. Define zoning and identify zone types.	Refer to Competency/Test Item Book VEC-IAE-C/TIB 8140, pp. 27-36.
4.2 Define the purpose of surveying and mapping in construction.	

Skills/Subject Area: Construction Technology

COMPETENCY GOAL 4: The learner will identify and describe the various elements involved in preparation for a construction project.

Objectives	Measures
4.3 Identify and describe the construction design process (e.g., design factors, design steps, drafting skills). a. Identify and apply steps in design process (identifying needs, developing ideas, refining ideas, identify problems, selecting best design, making working drawings).	
4.4 Identify design factors (e.g., function, safety, maintenance, appearance, and cost).	

Grade Level: 9-12 Skills/Subject Area: Construction Technology

COMPETENCY GOAL 5: The learner will identify concepts and demonstrate practical applications in site and foundation preparation/construction.

Objectives	Measures
5.1 Identify the operations which may need to be performed in site preparation (e.g., clearing, grading).	Refer to Competency/Test Item Book VEC-IAE-C/TIB 8140, pp. 37-45.
5.2 Identify foundation types (e.g., bearing surfaces, footings, upright supports).	
a. Identify and describe footing types (e.g., spread footings, pile footing, slab footing).	
5.3 Describe the steps and processes for building foundation walls.	
a. Perform basic construction skills (e.g., measuring and marking wood and steel, cutting wood and steel).	
b. Build forms and set reinforcements.	
c. Describe the mixing and placing process in masonry.	

VOCATIONAL EDUCATION
INDUSTRIAL ARTS EDUCATION

Grade Level: 9-12 Skills/Subject Area: Construction Technology

COMPETENCY GOAL 6: The learner will identify the concept of super structure and identify components of super structure as related to the technological system of construction.

Objectives	Measures
6.1 Define the term "super structure" as related to construction.	Refer to Competency/Test Item Book VEC-IAE-C/TIB 8140, pp. 46-57.
a. Identify and define a prefabricated floor (concrete and steel).	
b. Identify and describe floor framing terms (e.g., termite shield, anchor bolts, sill plate, joists, headers, bridging, subfloor, and vapor barrier).	
c. Define the following wall-framing terminology: load-bearing, partition.	
d. Identify masonry, framed, and prefabricated walls.	
e. Identify top plate, sole plate, corner post, tee post, studs, and braces.	
f. Identify door and window types.	
g. Identify and describe the purpose of the following roof and ceiling components: ceiling joists, rafter, ridge board, collar beam, and plywood sheathing.	
h. Identify and describe the advantages of several roof types.	

VOCATIONAL EDUCATION
INDUSTRIAL ARTS EDUCATION

Grade Level: 9-12 Skills/Subject Area: Construction Technology

COMPETENCY GOAL 7: The learner will define utilities in the technological system of construction and identify, describe, and plan utilities for construction.

Objectives	Measures
7.1 Define "utilities."	Refer to Competency/Test Item Book, VEC-IAE-C/TIB 8140, pp. 57-71.
7.2 Identify plumbing systems (e.g., cold and hot water, natural gas, fire protection, sewage removal, storm drainage, heating, and cooling).	
a. Identify common pipe types and sizes.	
b. Plan plumbing system properly.	
7.3 Describe the plumbing installation process.	
a. Identify and describe installation processes used with galvanized pipe, copper pipe, and plastic pipe.	
7.4 Identify factors to be considered in planning electrical systems for construction.	
7.5 Identify and describe electrical materials used in electrical systems (e.g., nonmetallic, unsheathed cable, armored cable, conduit).	

Grade Level: 9-12

Skills/Subject Area: Construction Technology

COMPETENCY GOAL 7: The learner will define utilities in the technological system of construction and identify, describe, and plan utilities for construction.

Objectives	Measures
7.6 Develop an electrical system plan for a construction project.	
a. Describe the "roughing in" process.	
b. Identify tools used in electrical construction.	
7.7 Identify emerging alternative energy sources for application in the construction industry.	

VOCATIONAL EDUCATION
INDUSTRIAL ARTS EDUCATION

Grade Level: 9-12 Skills/Subject Area: Construction Technology

COMPETENCY GOAL 8: The learner will describe the structure enclosures in the technological system of construction.

Objectives	Measures
8.1 Identify and describe the procedure for enclosing and finishing the exterior.	Refer to Competency/Test Item Book VEC-IAE-C/TIB 8140, pp. 72-78.
a. Identify and define sheathing materials.	
b. Identify and describe insulation materials for floors, walls, and ceiling.	
c. Identify and describe types of exterior finishing.	

VOCATIONAL EDUCATION
INDUSTRIAL ARTS EDUCATION

Grade Level: 9-12 Skills/Subject Area: Construction Technology

COMPETENCY GOAL 9: The learner will describe the concept of finish construction in the technological system of construction.

Objectives	Measures
9.1 Identify and describe the procedure for interior finishing.	Refer to Competency/Test Item Book VEC-IAE-C/TIB 8140, pp. 79-83.
9.2 Identify materials for covering floors, walls, ceilings.	
a. Identify and describe ways walls, floors, and ceilings are commonly finished.	
b. Identify the function and types of interior trim.	

VOCATIONAL EDUCATION
INDUSTRIAL ARTS EDUCATION

Grade Level: 9-12 Skills/Subject Area: Construction Technology

COMPETENCY GOAL 10: The learner will describe the concepts of operation and management as related to the technological system of construction.

Objectives	Measures
10.1 Identify consideration and steps for establishing a construction company (e.g., purpose, ownership, financing).	Refer to Competency/Test Item Book VEC-IAE-C/TIB 8140, pp. 84-93.
a. Define proprietorship, partnership, corporation.	
b. Identify financing considerations (e.g., stock, promissory notes).	
10.2 Describe the overall process for hiring and training construction workers.	
a. Identify the types of information commonly requested on application forms.	
b. Identify the steps in a job interview.	
c. Describe ways in which construction workers are trained.	

Grade Level: 9-12 Page 2

Skills/Subject Area: Construction Technology

COMPETENCY GOAL 10: The learner will describe the concepts of operation and management as related to the technological system of construction.

Objectives	Measures
10.3 Define estimating, bidding, and contracting as used in construction.	
a. Identify components in an invitation to bid/estimate (e.g., type of work, location, time and place where bids will be open, where and how to get plans and specifications for the project).	
b. Identify components of a contract (description of the project, location of the project, builder's responsibilities, owner's responsibilities, amount of money to be paid for completion of products, methods of payment).	

Grade Level: 9-12 Skills/Subject Area: Construction Technology

COMPETENCY GOAL 11: The learner will discuss the concept of marketing and real estate as related to the technological system of construction.

Objectives	Measures
11.1 Describe considerations in selecting housing (e.g., buy, rent, location, features).	Refer to Competency/Test Item Book VEC-IAE-C/TIB 8140, pp. 94-100.
a. Identify advantages/disadvantages of renting, leasing, buying a house.	
b. Identify factors that affect value of house (e.g., neighborhood, site, construction).	
11.2 Identify methods of selling and buying a home (e.g., personal sale, realtor).	
a. Describe the procedure for buying a house (e.g., offer to buy, contract a sale, earnest money, loan application, contract signing/closing).	
b. Define listing contract, listing MLS (multiple listing).	

Contemporary Technology Outline

1. Introduction

    a. Contemporary industry/technology--an overview
        (1) standard industrial classification system
        (2) industry in North Carolina (Dept. of Labor/Economic Development)
        (3) the systems of technology--rationale
        (4) orientation to the laboratory
        (5) class rules/procedures
        (6) class discussion/simulation
        (7) scope of contemporary industry/technology quiz and feedback
    b. Manufacturing
        (1) the systems model/overview of manufacturing
        (2) the concepts--definitions
        (3) the taxonomy
        (4) contemporary concepts and methods
        (5) contemporary concepts (CAD/CAM, computer integrated manufacturing, automation/cybernetics, robotics, and contemporary management system)
    c. Construction
        (1) the systems model/overview of construction
        (2) the concepts--definition
        (3) the taxonomy
        (4) contemporary concepts and methods
    d. Communication
        (1) the systems model/overview of communication
        (2) the concepts--definition of communication
        (3) the taxonomy--the scope of communication
        (4) contemporary concepts and methods
    e. Transportation/energy
        (1) the systems model/overview of transportation
        (2) the concepts--definition of transportation
        (3) the taxonomy--the scope of transportation
        (4) contemporary concepts and methods

VOCATIONAL EDUCATION
INDUSTRIAL ARTS EDUCATION

Grade Level: 8 Skills/Subject Area: Contemporary Technology

COMPETENCY GOAL 1: The learner will use the creative process to invent, innovate, and solve technical problems.

Objectives	Measures
1.1 Identify the steps in the creative process and use the identified process to develop/ evolve a product of contemporary use.	1.1.1 Employ the sequence of steps in the creative process to solve a technical problem (i.e., Universal Traveler).
	1.1.2 Plan a structure (within given technical specifications) which will support a maximum load.
1.2 Invent a new product.	1.2.1 Invent a new product which satisfies a need (performs a useful function) in contemporary society.
1.3 Innovate--evolve and use an existing procedure/product in a new way.	1.3.1 Modify an existing product or process in an innovative way.
	1.3.2 Redesign and construct a structure using the new knowledge gained from testing.

Grade Level: 8 Skills/Subject Area: Contemporary Technology

COMPETENCY GOAL 2: The learner will demonstrate technological knowledge of the systems of manufacturing, construction, communications, and transportation by explaining how selected contemporary technical developments work.

Objectives	Measures
2.1 Define technology and explain the difference between science and technology.	2.1.1 Describe the contemporary characteristics of the systems of manufacturing, construction, communication, and transportation.
	2.1.2 Define the terms science, technology, industry, society/culture, and education.
	2.1.3 Identify the relationship, the commonalities, and differences between these terms.
	2.1.4 Synthesize an operational definition for contemporary industry.

Grade Level: 8

Skills/Subject Area: Contemporary Technology

COMPETENCY GOAL 2: The learner will demonstrate technological knowledge of the systems of manufacturing, construction, communications, and transportation by explaining how selected contemporary technical developments work.

Objectives	Measures
2.2 Identify and explain the universal systems model associated with manufacturing, construction, communication, and transportation.	2.2.1 Manufacturing
	a. Define "manufacturing."
	b. Discuss the scope of contemporary manufacturing technology.
	c. Identify the systems model for manufacturing.
	d. Discuss the current trends and issues in manufacturing.
	2.2.2 Construction
	a. Define construction.
	b. Discuss the scope of contemporary construction technology.
	c. Identify the systems model for construction.
	d. Discuss the current trends and issues in construction.
	2.2.3 Communication
	a. Define communication.
	b. Discuss the scope of contemporary communication technology.
	c. Identify the systems model for communication.
	d. Discuss the current trends and issues in communication.

Grade Level: 8

Skills/Subject Area: Contemporary Technology

COMPETENCY GOAL 2: The learner will demonstrate technological knowledge of the systems of manufacturing, construction, communications, and transportation by explaining how selected contemporary technical developments work.

Objectives	Measures
	2.2.4 Transportation a. Define transportation. b. Discuss the scope of contemporary transportation technology. c. Identify the systems model for transportation. d. Discuss the current trends and issues in transportation.
2.3 Identify and explain the key technical concepts and principles which constitute the base of contemporary industry.	2.3.1 Conduct a destructive testing of the structure and record test observations and date.
	2.3.2 Analyze the critical factors and variables associated with structural/material failure.
	2.3.3 Make an oral presentation about contemporary communications technology.
	2.3.4 Evaluate the main sources of heating/cooling loss in a selected building.
	2.3.5 Evaluate the effectiveness of the manufacturing process and recommend improvements.
	2.3.6 Develop a list of contemporary concepts in technology and define their use.

Skills/Subject Area: Contemporary Technology

COMPETENCY GOAL 2: The learner will demonstrate technological knowledge of the systems of manufacturing, construction, communications, and transportation by explaining how selected contemporary technical developments work.

Objectives	Measures
2.4 Explain the appropriate use of selected categories of contemporary tools.	2.4.1 Identify representative tools and machines used in communication and identify their contemporary use and configuration. 2.4.2 Identify representative tools and machines used in construction and their contemporary use and configuration in industry. 2.4.3 Identify representative tools and machines used in manufacturing and their contemporary use and configuration in industry. 2.4.4 Identify representative tools and machines used in transportation and identify their contemporary use and configuration.

Skills/Subject Area: Contemporary Technology

COMPETENCY GOAL 2: The learner will demonstrate technological knowledge of the systems of manufacturing, construction, communications, and transportation by explaining how selected contemporary technical developments work.

Objectives	Measures
2.5 Identify the characteristics of a representative range of materials used in the contemporary communications industry.	2.5.1 Identify the materials and characteristics (materials properties) of a representative range of materials used in the contemporary communications industry.
	2.5.2 Identify the materials and characteristics (materials properties) of a representative range of materials used in the contemporary construction industry.
	2.5.3 Identify the materials and characteristics (materials properties) of a representative range of materials used to manufacture products in the contemporary industry.
	2.5.4 Identify the materials and characteristics (material properties) of a representative range of materials used in the contemporary transportation industry.

Grade Level: 8 Skills/Subject Area: Contemporary Technology

COMPETENCY GOAL 3: The learner will develop basic contemporary skills to construct projects.

Objectives	Measures
3.1 Use the cognitive technological process skills used by technologists to produce contemporary projects and solve technical problems.	3.1.1 Discuss the technological process skills employed by eminent technologists (i.e., Halfin).
	3.1.2 Manufacture a quality product which satisfies a current need in an efficient manner.
	3.1.3 Conduct aerodynamic testing (wind tunnel) of a range of efficient shapes.
	3.1.4 Propose a solution to a contemporary transportation problem and construct a representative model of your solution.
	3.1.5 Effectively propel and guide a constructed transportation vehicle to a specified target.

Grade Level: 8

Skills/Subject Area: Contemporary Technology

COMPETENCY GOAL 3: The learner will develop basic contemporary skills to construct projects.

Objectives	Measures
3.2 Develop basic contemporary skills to construct projects.	3.2.1 Use a computer to augment, control, and assist in the manufacturing operation.
	3.2.2 Develop sufficient computer skills to effectively use the computer in representative transportation applications.
	3.2.3 Develop beginning computer skills sufficient to use the computer in representative communications operations.
	3.2.4 Develop beginning computer skills of sufficient level to use the computer in representative construction operations.
	3.2.5 Develop sufficient tool/machine skills to safely produce a quality manufactured product.
	3.2.6 Develop sufficient tool/machine processing skills to safely conduct class assignments in communications.
	3.2.7 Develop sufficient tool/machine processing skills to safely conduct class assignments in transportation.
	3.2.8 Develop sufficient tool/machine skills to safely construct class assignments.
	3.2.9 Demonstrate an understanding of technical drawing and sketching (all areas).

Skills/Subject Area: Contemporary Technology

COMPETENCY GOAL 3: The learner will develop basic contemporary skills to construct projects.

Objectives	Measures
	3.2.10 Demonstrate the proper use of tools, materials, and processes representative of contemporary industry to manufacture a useful product (i.e., jig and fixture design).
3.3 Apply knowledge, skills, and resources, e.g., tools, materials, labor, and energy.	3.3.1 Construct a solar energy device and collect data to determine its efficiency.
	3.3.2 Construct a vehicle (package) which will safely protect two occupants (eggs) from specified conditions of impact.
	3.3.3 Design a system of graphics (e.g., poster, package, advertising, to effectively communicate with a specified audience and successfully market a product (Manufacturing).
	3.3.4 Construct an inflatable structure according to given specifications.
	3.3.5 Construct a structure according to the specifications given.
	3.3.6 Construct a model shelter which satisfies a current housing need (e.g., geodesic).
	3.3.7 Design and produce a working integrated (printed) circuit.

VOCATIONAL EDUCATION
INDUSTRIAL ARTS EDUCATION

Grade Level: 8 Skills/Subject Area: Contemporary Technology

COMPETENCY GOAL 4: The learner will organize and manage people to accomplish work efficiently and humanely.

Objectives	Measures
4.1 Organize people to efficiently accomplish a production task (i.e., task analysis).	4.1.1 Task analyze particular operations for optimal efficiency.
	4.1.2 Organize people in a humane way to efficiently produce a quality product.
	4.1.3 Become aware of the organizational structure of work.
4.2 Use contemporary management principles to accomplish work in a productive, humane way.	4.2.1 Use contemporary management practices to motivate personnel.
	4.2.2 Form quality circles to improve quality and productivity.

Skills/Subject Area: Contemporary Technology

COMPETENCY GOAL 4: The learner will organize and manage people to accomplish work efficiently and humanely.

Objectives	Measures
4.3 Identify the relationship and characteristics of jobs on a typical industrial organizational chart.	4.3.1 Identify the jobs and their relationships on a typical organizational chart from a contemporary industry.
	4.3.2 Identify the hierarchy of work and relationships.
	4.3.3 Identify a range of construction occupations and project future needs.
	4.3.4 Identify a range of communications occupations and project future needs.
	4.3.5 Identify a range of transportation occupations and project future needs.
	4.3.6 Identify the occupations with the largest number of workers and expected openings.
	4.3.7 Identify the emerging occupations which expect to experience the largest percentage of growth.

VOCATIONAL EDUCATION
INDUSTRIAL ARTS EDUCATION

Grade Level: 8 Skills/Subject Area: Contemporary Technology

COMPETENCY GOAL 5: The learner will calculate the value of selected products and services to use current economic statistics and data to categorize contemporary industry and to project (forecast) future trends.

Objectives	Measures
5.1 Calculate profit/loss, break even point, cost per unit, line balancing, and economy of motion/efficiency.	5.1.1 Perform representative calculations used in contemporary manufacturing. a. cost per unit produced. b. break even point calculations. c. profit/loss. d. line balancing. e. time/motion study. f. stock dividends. g. wages.
	5.1.2 Perform representative contemporary communications calculations.
	5.1.3 Perform representative contemporary transportation calculations.
	5.1.4 Perform representative contemporary construction calculations.
5.2 Interpret the Standard Industrial Classification System (SIC) of economic statistics.	5.2.1 Become familiar with the categories of industrial classification: a. National--Standard Industrial Classification (SIC). b. North Carolina--NC Economic Development data.
	5.2.2 Compare and contrast the similarities and differences between the SIC and NC Economic data.

Grade Level: 8

Skills/Subject Area: Contemporary Technology

COMPETENCY GOAL 5: The learner will calculate the value of selected products and services to use current economic statistics and data to categorize contemporary industry and to project (forecast) future trends.

Objectives	Measures
5.3 Be familiar with trends (technological forecasts) and construct possible scenarios.	5.3.1 Identify contemporary forms of transportation and forecast future developments.
	5.3.2 Plan and construct a display about contemporary communication technology.

VOCATIONAL EDUCATION
INDUSTRIAL ARTS EDUCATION

Grade Level: 8 Skills/Subject Area: Contemporary Technology

COMPETENCY GOAL 6: The learner will understand how manufacturing, construction, communication, and transportation technology provide for the needs of society.

Objectives	Measures
6.1 Identify the material needs of society, define the problem, and develop the appropriate technological response. (To use society as the base for the technological problems and projects developed.)	6.1.1 Distinguish between the needs and wants of society.
6.2 Perform a technology assessment (i.e. analyze the impact of a particular technology/industry; consumer impact).	6.2.1 Assess the impact (technology assessment/technological change) of an emerging communications technology development.
	6.2.2 Plan and design a technical publication/report (technology assessment).
6.3 Explain how manufacturing, construction, communication, and transportation technology provide for the material needs of society.	6.3.1 Explain how contemporary industry provides for the material needs of society.
	6.3.2 Distribute products to customers.
6.4 Recognize the value decisions employed in using the technology available (appropriate technology).	6.4.1 Describe appropriate technological values and how they can be applied to transportation/energy needs.

Energy/Power and Transportation Outline

1. Introduction to Energy/Power Transportation Technology

2. Careers Related to Energy/Power Transportation

3. The World's Energy Situation

    a. Direct and indirect sources of energy
    b. Renewable and nonrenewable sources of energy
    c. Conventional energy sources
    d. Selected alternative energy sources
    e. Methods of producing and possible future development of present and alternative energy sources
    f. Access to each energy source (conventional and selected alternative)

4. Scientific Principles of Practical Applications of Energy Conversion

    a. Law of Energy Conversion
    b. Four processes of converting chemical energy into useful power
    c. Internal combustion engines
    d. Servicing of small internal combustion engines
    e. Safe use of small internal combustion engine tools and equipment
    f. Operating principles of selected external combustion engines
    g. Law of motion and force
    h. Principle of fluidics (hydraulics and pneumatic)
    i. Wind energy
    j. Electrical processes for converting energy into power
    k. Magnetic processes for converting energy into useful power
    l. Commercial production of electricity in North Carolina
    m. Thermal and radiant processes in energy conversion
    n. Solar energy conversion
    o. Biomass, waste, alcohol, geothermal, gravity, peat, and wood converted into useful energy
    p. Consumerism or purchase-user of conversion techniques

5. Scientific Principles and Practical Applications of Energy Storage, Transmission, and Control

    a. Devices used to store converted energy
    b. Transmitting energy
    c. Transmission types
        (1) light
        (2) thermal
        (3) mechanical
        (4) chemical
    d. Methods of controlling power
    e. Heating efficiency (solar flat plates)
    f. Trees used for energy conservation
    g. Air heat grabbers

6. Scientific Principles of Practical Applications of Energy Conservation

   a. Concert "conservation ethic"
   b. Factors involved with saving energy
      (1) political
      (2) psychological
      (3) historical
      (4) socio-economic
   c. Private, commercial, industrial, and public sector approaches to conserving energy
   d. Energy use in transporting people
   e. Energy conservation in vehicle maintenance
   f. Energy conservation in driving habits
   g. Energy conservation in home energy audits
   h. Energy conservation in increased insulation of building
   i. Energy conservation in home furnishing
   j. Energy conservation in exterior and interior design of building

VOCATIONAL EDUCATION
INDUSTRIAL ARTS EDUCATION

Grade Level: 9-12

Skills/Subject Area: Energy/Power and Transportation Technology

COMPETENCY GOAL 1: The learner will identify the purpose and objectives of an industrial arts course in energy/power/transportation technology.

Objectives	Measures
1.1 Identify the basic reasons for studying energy and power technology.	Refer to Competency/Test Item Book VEC-IAE-C/TIB 8241, pp. 5-10.
1.2 List the problem that has been created by the energy crisis for the state, nation, and world.	
1.3 Distinguish among energy, power, and other items, e.g., work, horsepower.	
1.4 Identify the five past eras and possible future of energy and power.	
1.5 Describe the five general characteristics of energy (i.e., sources, types, conversion, uses, and conservation).	
1.6 List the basic systems, units, and instruments used to measure energy and power.	

VOCATIONAL EDUCATION
INDUSTRIAL ARTS EDUCATION

Grade Level: 9-12

Skills/Subject Area: Energy/Power and Transportation Technology

COMPETENCY GOAL 2: The learner will relate career information about energy/power/transportation technology with human knowledge, skills, abilities, and attitudes.

Objectives	Measures
2.1 Identify the duties, responsibilities, main job requirements, and training necessary for possible career options in energy and power.	Refer to Competency/Test Item Book VEC-IAE-C/TIB 8241, pp. 11-18.
2.2 Identify personal interest, physical characteristics, aptitudes, and mental abilities needed for each career option.	
2.3 Describe the transfer of skill process as it relates to possible energy and power career goals.	
2.4 Discuss how values affect lifestyles and career development aspects.	
2.5 Apply a decision-making process in choosing an occupation.	
2.6 List financial requirements for achieving tentative career goals.	
2.7 List the desirable employee traits and work habits (e.g., dependability, cooperation, pride in work, integrity).	
2.8 List energy and power training and educational opportunities at the public schools, post-secondary school, and college/university levels.	

VOCATIONAL EDUCATION
INDUSTRIAL ARTS EDUCATION

Grade Level: 9-12

Skills/Subject Area: Energy/Power and Transportation Technology

COMPETENCY GOAL 3: The learner will describe the world's energy situation.

Objectives	Measures
3.1 Distinguish between direct and indirect energy sources.	Refer to Competency/Test Item Book VEC-IAE-C/TIB 8241, pp. 10-24.
3.2 Distinguish between renewable and nonrenewable sources of energy.	
3.3 Identify the basic conventional energy sources.	
3.4 Name selected alternative energy sources.	
3.5 Identify methods of producing energy and possible future development of present and alternative energy sources.	
3.6 Assess each energy source (conventional and selected alternative) according to: availability, consumption-conservation, environmental impact, cultural impact, socioeconomic impact, political impact, historical values, and production and development.	

VOCATIONAL EDUCATION
INDUSTRIAL ARTS EDUCATION

Grade Level: 9-12

Skills/Subject Area: Energy/Power and Transportation Technology

COMPETENCY GOAL 4: The learner will describe scientific principles and demonstrate practical applications of energy conversion.

Objectives	Measures
4.1 Describe the law of energy conversion.	Refer to Competency/Test Item Book VEC-IAE-C/TIB 8241, pp. 25-51.
4.2 Identify four processes (oxidation, combustion, reduction, and ionization) of converting chemical energy into useful power.	
4.3 Describe the processes of oxidation conversion through selected products (e.g., fuel cell, batteries, fission sun, chemical heater).	
4.4 Identify the parts and principles of converting chemical energy into useful power through the internal combustion process in various cycle engines.	
4.5 Discuss how internal combustion engines are used, operated, and stored.	
4.6 Demonstrate how small internal combustion engines are serviced, diagnosed, disassembled, measured, repaired, assembled, and checked for performance.	
4.7 Demonstrate how selected small internal combustion engine hand tools and repair and diagnostic equipment are safely used.	

Grade Level: 9-12

Skills/Subject Area: Energy/Power and Transportation Technology

COMPETENCY GOAL 4: The learner will describe scientific principles and demonstrate practical applications of energy conversion.

Objectives	Measures
4.8 Describe the operating principles of selected external combustion engines (e.g., steam-piston and turbine, sterling).	
4.9 Show how the laws of motion and force are used to convert mechanical energy into a more useful form.	
4.10 Identify and apply the principles of fluidics (hydraulics and pneumatic) in obtaining mechanical conversion.	
4.11 Demonstrate how wind energy can be harnessed through construction and testing of specific devices.	
4.12 Identify electrical processes and means of converting energy into useful power.	
4.13 Describe the two basic electrical means (deals with electricity and flow of electrons) of converting energy.	
4.14 Identify, demonstrate, and give application for three electrical means (e.g., electrostatic fields, electron tube) of converting energy.	

Skills/Subject Area: Energy/Power and Transportation Technology

COMPETENCY GOAL 4: The learner will describe scientific principles and demonstrate practical applications of energy conversion.

Objectives	Measures
4.15 Explain the magnetic process (lines of force) of converting energy into useful power.	
4.16 Identify, demonstrate, and give applications for at least six magnetic means of converting electrical energy (solenoids, relays, transformers, deflection, laser).	
4.17 Demonstrate how to construct and control selected electrical devices through the process of electrical conversion (resistance, electromagnetic, electrolysis, and electrostatic).	
4.18 Describe how commercical electricity in North Carolina is produced, controlled, and distributed.	
4.19 Describe common applications of thermal (heat) and radiant (rays) processes of energy conversion.	
4.20 Identify and describe common applications of thermal processes of energy conversion (e.g., thermister, thermostat, thermocouple, thermonic, radiator, thermophotovoltaic converter (TPV), incandescence, heat exchange).	

Grade Level: 9-12

Skills/Subject Area: Energy/Power and Transportation Technology

COMPETENCY GOAL 4: The learner will describe scientific principles and demonstrate practical applications of energy conversion.

Objectives	Measures
4.21 Demonstrate how selected thermal energy conversion devices function (e.g., thermostat, thermometer, thermocouple).	
4.22 Identify and describe common applications of radiant processes of energy conversion (e.g., photoelectric-light to electricity, heating-warm to hot solar).	
4.23 Describe the sun's energy conversion through radiant and thermal means.	
4.24 Explain the various methods and means of how energy is harvested (converted) from the sun to useful purposes.	
4.25 Describe passive and active systems of collecting and applying solar energy.	
4.26 Demonstrate how to design and construct passive/active solar collector systems using liquid/air as mediums for gathering and controlling the energy.	
4.27 Discuss consumerism as a purchase-user of selected energy conversion techniques.	
4.28 Describe how biomass, waste, alcohol, geothermal, gravity, peat, and wood are converted to useful energy.	

Skills/Subject Area: Energy/Power and Transportation Technology

COMPETENCY GOAL 4: The learner will describe scientific principles and demonstrate practical applications of energy conversion.

Objectives	Measures
4.29 Explain the concept consumerism or purchase-user in relationship to other energy conversion techniques given in 4.28.	

VOCATIONAL EDUCATION
INDUSTRIAL ARTS EDUCATION

Grade Level: 9-12 Skills/Subject Area: Energy/Power and Transportation Technology

COMPETENCY GOAL 5: The learner will describe scientific principles and demonstrate practical applications of energy storage, transmission, and control.

Objectives	Measures
5.1 Identify, describe, and demonstrate the various devices (e.g., resevoir container, chemical, mechanical, and stockpile) and mediums (e.g., rock, chemical-solids, liquids and air) used to store converted energy.	Refer to Competency/Test Item Book VEC-IAE-C/TIB 8241, pp. 52-63.
5.2 Identify and describe the means (e.g., electrical, light, thermal, mechanical, liquid, and chemical) for transmitting energy.	
5.3 Identify and describe energy transmission methods (e.g., electrical, light, mechanical, chemical and thermal). Light--gas or vacuum medium (electromagnetic and radiation) solid media. (transparent material--glass transmission cable--translucent material). Thermal--gas media (e.g., conduction, convection, radiation); solid (conduction) liquid (conduction and convection). Mechanical--gas media (e.g., wind turbine, mill sails, pneumatic driven, and piston devices) solid media (e.g., belts and drive chain, cams linkage, explosives), liquid (e.g., hydraulic, water, turbine, oil).	

Grade Level: 9-12 Page 2

Skills/Subject Area: Energy/Power and Transportation Technology

COMPETENCY GOAL 5: The learner will describe scientific principles and demonstrate practical applications of energy, storage, transmission, and control.

Objectives	Measures
Chemical--gas media (fuel cell), solid media (dry cell), liquid media (wet cell).	
5.4 Identify and describe several examples of electrical and magnetic means for controlling power (e.g., relays, galvanometer, ommeter, oscilloscope, switches and regulators, resistors, transformers, solenoids, contactors, indicators and deflection systems).	
5.5 Describe several examples of controlling energy by mechanical means.	
5.6 Identify several examples of controlling energy/power through chemical-nuclear means (e.g., smoke detection, galvanometer, geiger counter).	
5.7 Identify several examples of controlling energy/power through thermal means.	
5.8 Identify several examples of controlling radiant energy/power devices.	
5.9 Explain how to calculate liquid solar collection area required for a family of four.	
5.10 Demonstrate heating efficiency of two different solar flat plate liquid collectors.	

Skills/Subject Area: Energy/Power and Transportation Technology

COMPETENCY GOAL 5: The learner will describe scientific principles and demonstrate practical applications of energy, storage, transmission, and control.

Objectives	Measures
5.11 Demonstrate how to place a flat plate collector to gain maximum all day radiant efficiency.	
5.12 Describe how different types of trees are used to take advantage of sun rays in winter and shade in summer.	
5.13 Demonstrate how to construct an air heat grabber and install in a structure.	

VOCATIONAL EDUCATION
INDUSTRIAL ARTS EDUCATION

Grade Level: 9-12

Skills/Subject Area: Energy/Power and Transportation Technology

COMPETENCY GOAL 6: The learner will describe scientific principles and demonstrate practical applications of energy conservation in our society.

Objectives	Measures
6.1 Describe the concert "conservation ethic" in terms of appropriate technology (ways and means of saving energy through the use of alternative sources and other means).	Refer to Competency/Test Item Book VEC-IAE-C/TIB 8241, pp. 63-86.
6.2 Describe the various political, historical, socio-economic, psychological, and future factors involved with saving energy.	
6.3 Discuss approaches for conserving energy in the private, commercial, industrial, and public sectors of society.	
6.4 Explain energy usage in transporting people and things.	
6.5 Describe the development and form of transporting people and things.	
6.6 Identify ways and means of conserving energy in transporting things (e.g., land, sea, and air).	
6.7 Identify ways and means of conserving energy in transporting people (e.g., land, sea, and air).	

Grade Level: 9-12 Page 2

Skills/Subject Area: Energy/Power and Transportation Technology

COMPETENCY GOAL 6: The learner will describe scientific principles and demonstrate practical applications of energy conservation in our society.

Objectives	Measures
6.8 Identify how to increase energy efficient vehicles by: a. reducing running resistance (e.g., air drag, bearing friction, acceleration, resistance, and tire). b. reducing vehicle weight (body , accessories, tires, running gear). c. reducing power loss (accessories, engine, design, drive train, lubrication).	Refer to Competency/Test Item Book VEC-IAE-C/TIB 8241
6.9 Demonstrate how to design, build and race an energy efficient automobile (use a land assault vehicle, Metric 500). a. design b. build c. race	
6.10 Discuss how thorough vehicle maintenance can save energy.	
6.11 Identify how to manage transportation systems to increase energy efficiency (e.g., traffic light patterns, highways, state and city transportation systems).	
6.12 Discuss how to select an energy efficient vehicle.	

Grade Level: 9-12

Skills/Subject Area: Energy/Power and Transportation Technology

COMPETENCY GOAL 6: The learner will describe scientific principles and demonstrate practical applications of energy conservation in our society.

Objectives	Measures
6.13 Describe the techniques of conserving energy through specific driving habits and trip management.	
6.14 Describe the process of performing a home energy audit.	
6.15 Demonstrate how to calculate heat gain and loss in a home energy audit.	
6.16 Identify and describe systems of home energy management.	
6.17 Describe (R) factor and its relation to insulating qualities of building materials needed for different heating zones in the United States.	
6.18 Identify steps that can be taken to save home energy usage.	
6.19 Identify items outside a structure (home) that can affect energy efficiency.	
6.20 Demonstrate how to perform basic home weatherization.	
6.21 Explain how home furnishing can affect use of energy.	

Skills/Subject Area: Energy/Power and Transportation Technology

COMPETENCY GOAL 6: The learner will describe scientific principles and demonstrate practical applications of energy conservation in our society.

Objectives	Measures
6.22 Describe exterior and interior architectural features of a home that will save energy.	
6.23 Discuss how to become home energy independent.	
6.24 Explain the techniques of saving energy in cooling a home.	
6.25 Describe ways to recycle materials to save energy.	
6.26 List public and private agencies and places where energy conservation information can be obtained by the consumer.	

Exploring Technology Outline

1. Introduction to Technology Development
    a. Industrial arts--a study of technology
    b. Leadership and personnel system

2. Area Identification (Tools and Machines)
    a. Subtopic identification
    b. Construction phase
        (1) model development
        (2) report development
        (3) display development
    c. Seminar phase

3. Area Identification (Communications and Transportation)
    a. Subtopic identification
    b. Construction phase
        (1) model development
        (2) report development
        (3) display development
    c. Seminar phase

4. Area Identification (Power and Energy)
    a. Subtopic identification
    b. Construction phase
        (1) model development
        (2) report development
        (3) display development
    c. Seminar phase

5. Area Identification (Manufacturing and Construction)
    a. Subtopic identification
    b. Construction phase
        (1) model development
        (2) report development
        (3) display development
    c. Seminar phase

6. Area Identification (Societal Concerns)

    a. Subtopic identification
    b. Construction phase
        (1) model development
        (2) report development
        (3) display development
    c. Seminar phase

7. In-Class Industrial Arts Student Association

VOCATIONAL EDUCATION
INDUSTRIAL ARTS EDUCATION

Grade Level: 7 Skills/Subject Area: Exploring Technology

COMPETENCY GOAL 1: The learner will become acquainted with factors which guide her/himself to select a given career.

Objectives		Measures	
1.1	Given information by the teacher, films, or speakers from industry, describe the logical steps in selection of work or occupation.	1.1.1	Conduct a personal assessment of work interest and aptitudes for two different occupations.
1.2	Provide an awareness of self.	1.2.1	List at least three questions one might ask in making career decisions.
1.3	Provide technological awareness (e.g., understanding of technology--its meaning, origin, nature development, impact, and consequence for society).	1.3.1	Choose one of the four adaptive systems (e.g., communication, transportation, construction, manufacturing) and list five ways technology has impacted that system.
1.4	Identify fundamental skills basic to occupations and careers.	1.4.1	Participate in an AIASA Competitive Events: a. public speaking or drawing interpretation b. wood product design c. exploring technology, and demonstrate knowledge of the three fundamental skills of communication, manual, and social interaction.

Grade Level: 7 Skills/Subject Area: Exploring Technology

COMPETENCY GOAL 2: The learner will identify worker's characteristics compatible with each of the six "work modes."

Objectives	Measures
2.1 Given the six "work modes," classify the personal behavior of an individual in that "work mode."	2.1.1 Identify an occupation that is related to each of the six "work modes," and list the occupations according to personal preference.

VOCATIONAL EDUCATION
INDUSTRIAL ARTS EDUCATION

Grade Level: 7 Skills/Subject Area: Exploring Technology

COMPETENCY GOAL 3: The learner will understand the importance of history in the development of technology.

Objectives	Measures
3.1 Given the eras of technology such as pre-history, age of the empire, modern craft era, machine age, power age, and the atomic age, accurately recall the importance of history in the development of technology for at least three of the six eras.	3.1.1 Recall the importance of history in the development of technology by listing the significance that at least three of the following eras of technology have had on the development of people and societies: a. pre-historic b. age of the empires c. modern crafts era d. machine age e. power age f. atomic age

Grade Level: 7 Skills/Subject Area: Exploring Technology

COMPETENCY GOAL 4: The learner will describe purposes of the anthropological approach to the study of technology.

Objectives	Measures
4.1 Given an introduction by the teacher using films or transparencies, describe at least three purposes of the anthropological approach to the unit study of technology, including the following: a. to recognize and apppreciate our material heritage b. to realize the inventiveness of the minds of the past c. to relate history to our technology today	4.1.1 List three purposes of the anthropological approach to the unit study of technology by describing our material heritage, inventive minds of the past, and relevance to today's technology.

Grade Level: 7 Skills/Subject Area: Exploring Technology

COMPETENCY GOAL 5: The learner will participate in an organized personnel system to manage class and laboratory activities.

Objectives	Measures
5.1 Given the list of in-class officers, committees, and the duties of each, participate in an organized personnel system for the class so that classroom and laboratory activities are managed effectively.	5.1.1 Participate in the class personnel system as an officer or member of a committee so that classroom and laboratory activities are effectively managed.

VOCATIONAL EDUCATION
INDUSTRIAL ARTS EDUCATION

Grade Level: 7 Skills/Subject Area: Exploring Technology

COMPETENCY GOAL 6: The learner will identify potential major areas of study for an anthropological unit.

Objectives	Measures
6.1 Given information about the development of technological elements common to mankind, identify potential major areas of study for an anthropological unit. The elements of transportation, communication, manufacturing, construction, tools and machines, and power and energy should be included.	6.1.1 Identify potential major areas of study for an anthropological unit. Include the following broad technological elements common to and contributing to all civilized societies: transportation, communication, manufacturing, construction, tools and machines, and power and energy.

VOCATIONAL EDUCATION
INDUSTRIAL ARTS EDUCATION

Grade Level: 7 Skills/Subject Area: Exploring Technology

COMPETENCY GOAL 7: The learner will describe criteria for the selection of a technological area of study.

Objectives	Measures
7.1 Given the list of major technological areas of study, describe the following criteria for the selection of a technological area of study: a. class interest b. available resources c. available tools d. available supplies	7.1.1 Describe and apply the following criteria in the selection of a technological area of study: a. class interest b. available resources c. available tools d. available supplies

Grade Level: 7 Skills/Subject Area: Exploring Technology

COMPETENCY GOAL 8: The learner will select a technological area of study.

Objectives		Measures	
8.1	Given the necessary instruction, discussion, and evaluation of the major areas of technology, select a technological area of study from the following list: transportation and communication, manufacturing and construction, tools and machines, power and energy, or their resulting societal concerns.	8.1.1	Using established criteria, select a technological area of study from the following list: transportation and communication, manufacturing, and construction, tools and machines, power and energy, or their resulting societal concerns.

VOCATIONAL EDUCATION
INDUSTRIAL ARTS EDUCATION

Grade Level: 7 Skills/Subject Area: Exploring Technology

COMPETENCY GOAL 9: The learner will list possible subtopics under a selected technological area of study.

Objectives	Measures
9.1 Given a chosen technological area of study, list at least three subtopics for the selected area of study.	9.1.1 List at least three possible subtopics for the selected technological area of study.

VOCATIONAL EDUCATION
INDUSTRIAL ARTS EDUCATION

Grade Level: 7 Skills/Subject Area: Exploring Technology

COMPETENCY GOAL 10: The learner will identify criteria for the selection of an area subtopic.

Objectives	Measures
10.1 Given general information regarding criteria selection, identify the criteria for the selection of the area subtopic, including at least five of the following:	10.1.1 Identify criteria used when selecting a technological area subtopic. Include at least five of the following:
a. has made a contribution to the growth of civilization	a. has made a contribution to the growth of civilization
b. has a history which may be traced	b. has a history which may be traced
c. is of personal interest	c. is interesting to you
d. involves a variety of construction operations and materials	d. involves a variety of construction operations and materials
e. has moving parts if possible	e. has moving parts if possible
f. is socially acceptable	f. is socially acceptable
g. lends itself to available resource material	g. lends itself to available resource material

VOCATIONAL EDUCATION
INDUSTRIAL ARTS EDUCATION

Grade Level: 7 Skills/Subject Area: Exploring Technology

COMPETENCY GOAL 11: The learner will select a subtopic to study.

Objectives	Measures
11.1 Given the technological area selected to study and a tour of the industrial arts facilities to determine tools and supplies available, select a subtopic of study, using established criteria.	11.1.1 Select a subtopic of study from a major area of technological study, using established criteria.

VOCATIONAL EDUCATION
INDUSTRIAL ARTS EDUCATION

Grade Level: 7 Skills/Subject Area: Exploring Technology

COMPETENCY GOAL 12: The learner will list standards for student expectation levels.

Objectives	Measures
12.1 Given the three components of a completed unit study, list, to the instructor's and class's satisfaction, standards that students should follow in making a model, a report, and a display. The following must be included in the standards:	12.1.1 List, to the instructor's satisfaction, standards that students should follow in making a model, a report, and a display. The following must be included in the standards:
a. a pictorial sketch and working drawing	a. a pictorial sketch an working drawing
b. an accurate model	b. an accurate model
c. a report of research on contribution to civilization	c. a report of research on contribution to civilization
d. a display with charts, posters, photos, diagrams, and titles of the unit study.	d. a display with charts, posters, photos, diagrams, and titles of of the unit study.

VOCATIONAL EDUCATION
INDUSTRIAL ARTS EDUCATION

Grade Level: 7 Skills/Subject Area: Exploring Technology

COMPETENCY GOAL 13: The learner will identify available resources, tools, and materials to meet unit instructional goals.

Objectives	Measures
13.1 Given a tour of the school's Industrial Arts facilities and library, identify all resources, tools, machines, and materials available to construct model and prepare bill of materials for approval by teachers.	13.1.1 Prepare a bill of materials needed for constructing model. The bill of materials will be checked by teacher to determine if all materials are identified.

VOCATIONAL EDUCATION
INDUSTRIAL ARTS EDUCATION

Grade Level: 7 Skills/Subject Area: Exploring Technology

COMPETENCY GOAL 14: The learner will demonstrate project planning procedures.

Objectives	Measures
14.1 Given a presentation and handouts, demonstrate skilled project planning procedures, including sketching, lettering, drawing, researching, consulting, construction steps, and materials that apply directly to the chosen subtopic.	14.1.1 Demonstrate skill in project planning procedures, including sketching, lettering, drawing, researching, consulting, construction steps, and materials. Instructor will evaluate for completeness and accuracy.

VOCATIONAL EDUCATION
INDUSTRIAL ARTS EDUCATION

Grade Level: 7 Skills/Subject Area: Exploring Technology

COMPETENCY GOAL 15: The learner will demonstrate skill in preparing working drawings.

Objectives	Measures
15.1 Given drawing instruments, bill of materials, tool list, and a plan of procedure for constructing a subtopic project, make a working drawing for the project. Drawing must show correct views and have all dimensions provided.	15.1.1 Make a working drawing for a subtopic project. Drawing must show correct views and have all dimensions provided so that model could be constructed by another person.

VOCATIONAL EDUCATION
INDUSTRIAL ARTS EDUCATION

Grade Level: 7 Skills/Subject Area: Exploring Technology

COMPETENCY GOAL 16: The learner will select and use proper tools and appropriate materials.

Objectives	Measures
16.1 Given layout, cutting, drilling, and sanding tools, select and use the necessary items to construct a unit model. Proper techniques and safety precautions, as demonstrated by teacher, must be involved in construction.	16.1.1 Select tools and materials and use them in the construction of a unit model. Techniques and safety rules will be checked by teacher during laboratory work time and at completion of model.

VOCATIONAL EDUCATION
INDUSTRIAL ARTS EDUCATION

Grade Level: 7 Skills/Subject Area: Exploring Technology

COMPETENCY GOAL 17: The learner will assemble a unit model and apply desired finishes.

Objectives	Measures
17.1 Given fastening tools, adhesives, hardware, and necessary finishing materials properly assemble a unit model and apply desired finishes outlined in the bill of materials.	17.1.1 Assemble a unit model properly according to drawings, and apply desired finishes outlined in the bill of materials. Assembly and finish will be checked by teacher in comparison to plans and demonstrated techniques.

VOCATIONAL EDUCATION
INDUSTRIAL ARTS EDUCATION

Grade Level: 7 Skills/Subject Area: Exploring Technology

COMPETENCY GOAL 18: The learner will prepare a written report on a technological subtopic.

Objectives	Measures
18.1 Given necessary information, write a report on the selected technological subtopic. The outline and standards established by the class should include the following: purpose, procedures followed, schematics or pictures, historical or scientific factors, social contributions, equipment used, references and resources contacted.	18.1.1 Prepare a written anthropological unit report to include purpose, procedures followed, schematics or pictures, historical or scientific factors, social contributions, equipment used, and references and resources contacted. Standards established by the class must be followed.

Grade Level: 7 Skills/Subject Area: Exploring Technology

COMPETENCY GOAL 19: The learner will construct display for unit model.

Objectives	Measures
19.1 Given display techniques, construct a back drop display to exhibit an anthropological unit of study according to established criteria.	19.1.1 Display your model and written report in a back drop display constructed to include charts, diagrams, technical illustrations, schematics, and lettering for title of subtopic.

Grade Level: 7 Skills/Subject Area: Exploring Technology

COMPETENCY GOAL 20: The learner will organize and prepare an oral seminar report on a subtopic.

Objectives	Measures
20.1 After observing a teacher-directed discussion, organize and prepare an oral seminar report for presentation on an individual subtopic. Report should be from three to four minutes in length and completed to the instructor's satisfaction.	20.1.1 Organize and prepare an oral seminar report for presentation on an individual subtopic. Report should be from three to four minutes in length.

Grade Level: 7 Skills/Subject Area: Exploring Technology

COMPETENCY GOAL 21: The learner will demonstrate how to conduct a progress seminar, using an established format.

Objectives	Measures
21.1 Given appropriate materials and equipment, demonstrate how to conduct a seminar, using an established format.	21.1.1 Demonstrate how to conduct a seminar, following an established format and agenda.

VOCATIONAL EDUCATION
INDUSTRIAL ARTS EDUCATION

Grade Level: 7 Skills/Subject Area: Exploring Technology

COMPETENCY GOAL 22: The learner will describe the effects technology has had on people and society.

Objectives	Measures
22.1 Given presentation opportunities, describe the effects technology has had on people and society as discovered during subtopic research and documentation. The presentation must be rated satisfactorily in accordance with pre-established criteria.	22.1.1 Accurately describe the effects that technology has had on people and societies through participation in seminar oral reports and discussion of information presented. Teacher will observe participation and check descriptions used in discussions.

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Grade Level: 7 Skills/Subject Area: Exploring Technology

COMPETENCY GOAL 23: The learner will select community resources for technological information.

Objectives	Measures
23.1 Given the subtopic chosen for unit study, select resources for technological information from the list prepared by the class committee.	23.1.1 Select resources from community for technological information, model construction, and report on subtopic. A comprehensive community resource list prepared by a class committee will be used.

VOCATIONAL EDUCATION
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Grade Level: 7 Skills/Subject Area: Exploring Technology

COMPETENCY GOAL 24: The learner will participate in the group planning, organizing, and carrying out of activities and projects to improve or serve the school.

Objectives	Measures
24.1 Given a list of possible activities or projects, as a group, plan, organize, and carry out activities which contribute to an improvement in, or service, to, the school. The activity should follow guidelines presented by teacher.	24.1.1 Help plan, organize, and carry out activities which contribute to an improvement in, or service to, the school. The activity should follow the guidelines presented by teacher.

Grade Level: 7 Skills/Subject Area: Exploring Technology

COMPETENCY GOAL 25: The learner will operate an enterprise with other students.

Objectives	Measures
25.1 Given a variety of items that can be produced, select an item to be used in operating an enterprise system according to established standards of quality and productivity.	25.1.1 Select and operate an enterprise system to produce a product of economic value. System should have quality control and be efficient to realize a profit for the group or class association.

VOCATIONAL EDUCATION
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Grade Level: 7 Skills/Subject Area: Exploring Technology

COMPETENCY GOAL 26: The learner will participate with other students in competitive events.

Objectives	Measures
26.1 Given the necessary rules and registration information, participate with other students in competitive events involving information and activities related to this course.	26.1.1 Participate with other students in competitive events to motivate and recognize achievement. Contests entered shall involve information and activities related to this course.

Graphic Arts Technology Outline

1. Introduction to Graphic Arts Technology

2. Career Information Related to Graphic Arts Technology

3. Letterpress Printing

   a. History
   b. Platen press
   c. Typography
   d. Multiform letterpress
   e. Power platen press
   f. Safety
   g. Relief printing

4. Screen Printing

   a. History
   b. Hand-cut stencil
   c. Photographic silk screen printing
   d. Nonphotographic positives

5. Offset Lithography

   a. Basic principles of offset lithography
   b. Educational needs and occupations
   c. Nonphotographic negatives
   d. 2-color project
   e. Safety and offset press operations

6. Concepts of Design in Graphic Arts Industry

7. Concepts of Composition in Graphic Arts Industry

8. Principles of Line Photography in the Graphic Arts Industry

   a. Occupational opportunities
   b. Principles and mechanics of line photography
   c. Operating an industrial copy camera
   d. Handling, exposing, developing, fixing
   e. Safety procedures in the darkroom
   f. Plate-making
   g. Offset press operation

9. Candid Photography in the Graphic Arts Industry

   a. Educational needs and occupational opportunities
   b. History of photography
   c. Equipment of photography

d. Kinds of photography
   (1) candid
   (2) live
   (3) halftone
   (4) color
   (5) portrait
e. Exposing and developing photographic panchromatic film
f. Making photographic prints using the enlarger

10. Paper Technology within the Graphic Arts Industry

   a. Mathematical and operational procedures in paper (utilization)
   b. Scope of occupations in the paper industry
   c. Kinds of paper and weight of paper
   d. Paper cutting
   e. Estimating paper needs for selected jobs
   f. Safety procedures of the paper cutter
   g. Paper cutter operations

11. Technology and Applications of Chemical Principles in Ink Utilization

   a. Manufacture of ink
   b. Kinds of ink
   c. Production techniques of paint shop operation

12. Bookbinding in the Graphic Arts Industry

   a. Principles of bookbinding
   b. Rebinding magazines and old books
   c. Thesis binding
   d. Procedures of binding book
      (1) quarter bound
      (2) half bound
      (3) three quarter bound

13. Half-Tone Photography in the Graphic Arts Industry

14. Screen Tint Printing

15. Duotone Printing

16. Photographic Processes in Screen Printing

17. Photographic Offset Processes in Offset Lithography

VOCATIONAL EDUCATION
INDUSTRIAL ARTS EDUCATION

Grade Level: 10-12 Skills/Subject Area: Graphic Arts Technology

COMPETENCY GOAL 1: The learner will identify the objectives of an industrial arts program in graphic arts.

Objectives		Measures	
1.1	Describe the major objectives of the instructional program.	1.1.1	Identify the objectives of graphic arts as an industrial arts program.

VOCATIONAL EDUCATION
INDUSTRIAL ARTS EDUCATION

Grade Level: 10-12 Skills/Subject Area: Graphic Arts Technology

COMPETENCY GOAL 2: The learner will relate career information about graphic arts technology with human knowledge, skills, abilities, and attitudes.

	Objectives		Measures
2.1	Identify personal interests, physical characteristics, aptitudes, and mental abilities.	2.1.1	Using the headings listed below, identify your unique strengths: a. personal interests b. physical characteristics c. aptitudes d. mental abilities
2.2	Identify possible career options consistent with abilities and aspirations.	2.2.1	List three possible graphic arts careers that fit your abilities and aspirations.
2.3	Describe how value judgements affect lifestyles and career aspirations.	2.3.1	Explain how value judgements can affect your lifestyle and career aspirations.
2.4	Describe relationship between attitude and success in life and work.	2.4.1	Describe the relationship between attitude and success in life and work.
2.5	Describe the "transfer of skill" as it relates to tentative occupational career goals.	2.5.1	Describe the "transfer of skill" as it applies to tentative occupational career goals.
2.6	Use decision-making processes in making occupational choices.	2.6.1	Choose an occupation in graphic arts and demonstrate how you use the decision-making process to determine if you should consider employment.

Grade Level: 10-12 Page 2

Skills/Subject Area: Graphic Arts Technology

COMPETENCY GOAL 2: The learner will relate career information about graphic arts technology with human knowledge, skills, abilities, and attitudes.

Objectives	Measures
2.7 Identify educational and financial requirements for achieving tentative career goals.	2.7.1 Identify a tentative career goal and describe the education and financial requirements.
2.8 List a cluster of occupations.	2.8.1 Name a cluster of occupations in graphic arts.
2.9 Identify desirable employee traits.	2.9.1 List the traits of a good employee.
2.10 List training opportunities at the high school, post-secondary, and college or university level.	2.10.1 Identify the types of jobs one might expect as a result of: a. high school training b. post-secondary training c. college/university training

Grade Level: 10-12 Skills/Subject Area: Graphic Arts Technology

COMPETENCY GOAL 3: The learner will describe the scope of employment opportunities in the graphic arts industry.

Objectives	Measures
3.1 Describe the size, nature, and occupational opportunities of the graphic arts industry.	3.1.1 The graphic arts industry is the _________ largest industry in the United States.
	3.1.2 List 10 occupational opportunities in the graphic arts industry: _____ _____ _____ _____ _____ _____ _____ _____ _____ _____
3.2 Describe three basic methods of printing and their uses, i.e., relief, planographic, and intaglio.	3.2.1 List three methods of printing and identify the uses of each method: Method Uses ______ ____________________ ______ ____________________ ______ ____________________

VOCATIONAL EDUCATION
INDUSTRIAL ARTS EDUCATION

Grade Level: 10-12　　Skills/Subject Area: Graphic Arts Technology

COMPETENCY GOAL 4: The learner will describe letterpress printing as a part of the graphic arts industry and demonstrate concepts of letterpress printing.

Objectives	Measures
4.1 Identify the educational needs and occupational opportunities of the letterpress printer.	4.1.1 Circle the most correct answer: There are a. many b. an average number c. few jobs available in letterpress printing.
4.2 Describe and update the history of letterpress printing.	4.2.1 Briefly describe the history of letterpress printing.
4.3 Describe the basic platen press procedure.	4.3.1 Explain the principle of letterpress printing.
4.4 Describe the basics of typography or type design, i.e., type style, type size, and type color, and their psychological implications to insure effective communications.	4.4.1 Define "typography."
	4.4.2 Name four basic type styles and indicate the uses of each style.
	4.4.3 Explain the effects of type size in graphic design.
	4.4.4 What kind of message does each of the colors below convey to the public? Red ______　Orange ______ Blue ______　Purple ______ Yellow ______ Green ______

Skills/Subject Area: Graphic Arts Technology

COMPETENCY GOAL 4: The learner will describe letterpress printing as a part of the graphic arts industry and demonstrate concepts of letterpress printing.

Objectives	Measures
4.5 Describe and demonstrate the methods and procedures of multi-form letterpress printing, i.e., 2 color, work-and-turn, work-and-flip.	4.5.1 Write the steps in producing the following on the platen press: a. two-color b. work-and-turn c. work-and-flip 4.5.2 Teacher evaluation of student work.
4.6 Describe and demonstrate the correct procedure of operating a power platen press.	4.6.1 List the steps in operating the power platen press. 4.6.2 Teacher evaluation of student operation of platen press.
4.7 Identify the necessary safety precepts of operating a power platen press.	4.7.1 List safety rules to be observed in operating a power platen press.
4.8 Describe the basic methods of using relief type to manufacture a rubber stamp, i.e., matrix and vulcanization of uncured rubber.	4.8.1 List the steps in the manufacture of a rubber stamp.

VOCATIONAL EDUCATION
INDUSTRIAL ARTS EDUCATION

Grade Level: 10-12 Skills/Subject Area: Graphic Arts Technology

COMPETENCY GOAL 5: The learner will describe screen printing as a part of the graphic arts industry and demonstrate concepts of screen printing.

Objectives	Measures
5.1 Describe the history of screen process printing.	5.1.1 Briefly describe the history of screen process printing.
5.2 Identify the educational needs and occupational opportunities in the screen process industry.	5.2.1 Identify the kinds of jobs available in the screen process industry and describe the level of education needed for each kind of job.
5.3 Describe the hand-cut stencil silk screen procedure.	5.3.1 List the steps in the hand-cut stencil silk screen procedure.
5.4 Describe the two basic methods of photographic silk screen printing, i.e., transfer film and direct emulsions.	5.4.1 Describe two methods of photographic silk screen printing.
5.5 Identify and demonstrate the methods of manufacturing non-photographic positives.	5.5.1 Identify three methods of making nonphotographic positives.
	5.5.2 Teacher evaluation of student production of non-photographic positives.
5.6 Describe and demonstrate the procedure of exposing, developing, washingout, and adhering photographic transfer film.	5.6.1 List the steps in preparing a screen with photographic transfer film.
	5.6.2 Teacher evaluation of student work.
5.7 Describe and demonstrate the procedure of mixing, coating, exposing, and washing out a direct emulsion silk screen.	5.7.1 List the steps in preparing a direct emulsion silk screen.
	5.7.2 Teacher evaluation of student work.

Grade Level: 10-12 Skills/Subject Area: Graphic Arts Technology

COMPETENCY GOAL 6: The learner will describe offset lithography as a part of the graphic arts industry and demonstrate concepts of offset lithography.

Objectives	Measures
6.1 Describe the basic principles and procedures of offset lithography.	6.1.1 Explain the scientific principles of offset lithography. 6.1.2 List the steps in operating an offset press.
6.2 Identify the educational needs and occupational opportunities in the lithography printing industry.	6.2.1 Identify the kinds of jobs available in offset lithography and describe the level of education needed for each job.
6.3 Describe and demonstrate the methods of producing nonphotographic (mechanical) negatives.	6.3.1 What are two methods of producing nonphotographic negatives? 6.3.2 Teacher evaluation of student work.
6.4 Describe and demonstrate the correct procedure for exposing and developing a lithographic plate.	6.4.1 List the steps in exposing and developing a lithographic plate. 6.4.2 Teacher evaluation of student work.
6.5 Describe and demonstrate the proper methods of producing a registered two-color lithographic plate.	6.5.1 Explain the procedure for producing a registered two-color lithographic project. 6.5.2 Teacher evaluation of student work.
6.6 Identify safety practices of platemaking and offset press operation.	6.6.1 List safety rules to be observed in platemaking. 6.6.2 List safety rules to be observed in operating an offset press.

VOCATIONAL EDUCATION
INDUSTRIAL ARTS EDUCATION

Grade Level: 10-12 Skills/Subject Area: Graphic Arts Technology

COMPETENCY GOAL 7: The learner will describe the concept of design as it applies to the graphic arts industry.

Objectives	Measures
7.1 Describe the importance of good design to increase the communicative aspects of a printed product.	7.1.1 How does good design relate to the ability of a printed product in communicating a message to the public?
7.2 Identify the educational needs and occupational opportunities of the graphic designer.	7.2.1 List jobs available for graphic designers and describe the level of education needed for the jobs.
7.3 Describe and demonstrate the principles of design, i.e., formal and informal balance, cut arrangement, and other basic concepts.	7.3.1 List the principles involved in creating a good design.
	7.3.2 Teacher evaluation of student work.

VOCATIONAL EDUCATION
INDUSTRIAL ARTS EDUCATION

Grade Level: 10-12 Skills/Subject Area: Graphic Arts Technology

COMPETENCY GOAL 8: The learner will describe the concepts of composition as it relates to the graphic arts industry.

Objectives		Measures	
8.1	Identify and demonstrate various methods of mechanical cold type composition, i.e., hand lettering devices, clip art, pattern tape, tab type, typewriter (impact) composition, and impact composing machines.	8.1.1	List five methods of mechanical cold type composition.
		8.1.2	Teacher evaluation of student work.
8.2	Identify and demonstrate various methods of photographic cold type composition.	8.2.1	List three methods of photographic cold type composition.
		8.2.2	List three methods of photographic cold type composition.
8.3	Demonstrate the proper methods of preparing camera ready layouts, i.e., paste-ups and mechanicals.	8.3.1	Teacher evaluation of student work.

VOCATIONAL EDUCATION
INDUSTRIAL ARTS EDUCATION

Grade Level: 10-12 Skills/Subject Area: Graphic Arts Technology

COMPETENCY GOAL 9: The learner will describe and demonstrate the principles of line photography in the graphic arts industry.

Objectives		Measures	
9.1.	Identify the educational needs and occupational opportunities of the industrial photographer.	9.1.1	List job opportunities available for industrial photographers and describe the level of education needed for each job.
9.2	Identify the principles and mechanics of line photography.	9.2.1	Explain the principles of line photography.
		9.2.2	Briefly describe the process of producing line photography.
9.3	Demonstrate the correct procedure for operating an industrial copy camera.	9.3.1	Teacher evaluation of student procedures in operating an industrial copy camera.
9.4	Describe and demonstrate the proper procedure for handling, exposing, developing, and fixing	9.4.1	List the steps in producing a negative using orthochromatic film.
		9.4.2	Teacher evaluation of student work.
9.5	Identify safety procedures of handling film and chemicals in the darkroom.	9.5.1	List darkroom safety procedures.
9.6	Identify and demonstrate procedures for stripping and opaquing line negatives using stripping of lineup masters to produce a flat.	9.6.1	List the steps in producing a flat using line negatives.
		9.6.2	Teacher evaluation of student work.

Skills/Subject Area: Graphic Arts Technology

COMPETENCY GOAL 9: The learner will describe and demonstrate the principles of line photography in the graphic arts industry.

Objectives		Measures	
9.7	Demonstrate the plate-making procedure.	9.7.1	Teacher evaluation of student procedures in platemaking.
9.8	Demonstrate offset press operations.	9.8.1	Teacher evaluation of student operational procedures on the offset press.

VOCATIONAL EDUCATION
INDUSTRIAL ARTS EDUCATION

Grade Level: 10-12 Skills/Subject Area: Graphic Arts Technology

COMPETENCY GOAL 10: The learner will describe and demonstrate the principles of candid photography in the graphic arts industry.

Objectives	Measures
10.1 Identify the educational needs and occupational opportunities of several photographic fields.	10.1.1 Identify job opportunities for photographers and describe the levels of education needed for each job.
10.2 Describe the history of photography.	10.2.1 Briefly describe the history of photography.
10.3 Describe the principles of photography.	10.3.1 Explain the principles of photography.
10.4 Identify the necessary tools and equipment of photography.	10.4.1 Make a list of tools and equipment needed by a photographer.
10.5 Describe the differences between several kinds of photography, i.e., candid, live, halftone, color, and portrait.	10.5.1 Define each of the following: a. candid photography b. live photography c. halftone photography d. color photography e. portrait photography

Grade Level: 10-12

Skills/Subject Area: Graphic Arts Technology

COMPETENCY GOAL 10: The learner will describe and demonstrate the principles of candid photography in the graphic arts industry.

Objectives	Measures
10.6 Describe and demonstrate the correct procedure of exposing and developing panchromatic film.	10.6.1 List the steps in exposing panchromatic film. 10.6.2 List the steps in developing panchromatic film.
10.7 Demonstrate the procedure for making photographic prints using the enlarger.	10.7.1 List the steps for making photographic prints using the enlarger. 10.7.2 Teacher evaluation of student work.

VOCATIONAL EDUCATION
INDUSTRIAL ARTS EDUCATION

Grade Level: 10-12 Skills/Subject Area: Graphic Arts Technology

COMPETENCY GOAL 11: The learner will describe the relationship of paper technology to the graphic arts industry and demonstrate mathematical and operational procedures in paper utilization.

Objectives	Measures
11.1 Describe the importance of paper and its uses in a modern technological society.	11.1.1 How is paper used in a modern technological society?
11.2 Identify the scope of occupations in paper technology including educational needs and employment opportunities.	11.2.1 Identify job opportunities in paper technology and describe the level of education needed for each job.
11.3 Describe the manufacture of paper.	11.3.1 Describe the major steps in the paper manufacturing process.
11.4 Identify the many different kinds of papers, weights, and specifications and their industrial uses.	11.4.1 List five kinds of paper and indicate the industrial use of each kind.
	11.4.2 What is the appropriate weight of paper for each use below: a. one-side print b. two-side print c. posters d. package wrapping
11.5 Describe the necessity of figuring and planning proper paper cutting.	11.5.1 Why is pre-planning important in paper cutting?

Grade Level: 10-12

Skills/Subject Area: Graphic Arts Technology

COMPETENCY GOAL 11: The learner will describe the relationship of paper technology to the graphic arts industry and demonstrate mathematical and operational procedures in paper utilization.

Objectives	Measures
11.6 Identify and demonstrate several methods of figuring paper needs for selected jobs.	11.6.1 Describe two methods of figuring paper needs for a printing project.
	11.6.2 Teacher evaluation of student work.
11.7 Identify and demonstrate the proper operation of the paper cutter.	11.7.1 List the steps in separating a paper cutter.
	11.7.2 Teacher evaluation of student procedures in operating a paper cutter.
11.8 Identify safety procedures of the paper cutter.	11.8.1 List safety procedures in operating a paper cutter.

VOCATIONAL EDUCATION
INDUSTRIAL ARTS EDUCATION

Grade Level: 10-12 Skills/Subject Area: Graphic Arts Technology

COMPETENCY GOAL 12: The learner will describe the relationship of ink technology to the graphic arts industry and demonstrate the application of chemical principles in ink utilization.

Objectives	Measures
12.1 Describe the manufacture of ink.	12.1.1 Describe the major steps in the manufacture of ink.
12.2 Identify the scope of occupations in ink technology, including educational needs and occupational opportunities.	12.2.1 Identify job opportunities in ink technology and describe the levels of education needed for each job.
12.3 Identify the various kinds of ink, ink additives, and demonstrate basic ink mixing.	12.3.1 List five kinds of ink used in printing.
	12.3.2 Define "ink additives" and give some examples of additives.
	12.3.3 Teacher evaluation of student procedures in ink mixing.
12.4 Identify several production techniques of print shop operation and apply one or more in regular class operations.	12.4.1 Describe two types of production techniques used in print shop operation.
12.5 Identify occupations in production management, including educational needs and employment opportunities.	12.5.1 Identify job opportunities in production management and describe levels of education needed for each job.

VOCATIONAL EDUCATION
INDUSTRIAL ARTS EDUCATION

Grade Level: 10-12 Skills Subject Area: Graphic Arts Technology

COMPETENCY GOAL 13: The learner will describe bookbinding and its relationship to the graphic arts industry and demonstrate principles of bookbinding.

Objectives	Measures
13.1 Describe the history of bookbinding.	13.1.1 Briefly describe the history of bookbinding.
13.2 Identify the educational needs and occupational opportunities of the book industry, i.e., publishing, collecting and selling, rebinding.	13.2.1 Identify job opportunities in the book industry and describe the levels of education needed for each job.
13.3.Describe the procedure of binding a book, i.e., sewing and casemaking.	13.3.1 List major steps in binding a book.
13.4 Describe and demonstrate the methods of re-binding magazines and old books.	13.4.1 List major steps in rebinding magazines and old books. 13.4.2 Teacher evaluation of student work.
13.5 Describe and demonstrate thesis binding.	13.5.1 List the steps in thesis binding. 13.5.2 Teacher evaluation of student work.
13.6 Describe and demonstrate the procedure for binding quarter-bound, half-bound, and three-quarter bound books.	13.6.1 List the procedures used for the following: a. quarter-bound book b. half-bound book c. three-quarter bound book 13.6.2 Teacher evaluation of student work.

Grade Level: 10-12 Skills/Subject Area: Graphic Arts Technology

COMPETENCY GOAL 14: The learner will demonstrate chemical and physical principles of half-tone photography in the graphic arts industry.

Objectives	Measures
14.1 Describe the theory and application of halftone photography and printing.	14.1.1 Discuss the theory of halftone photography and its uses in printing.
14.2 Identify safety procedures in handling film and chemicals.	14.2.1 List safety procedures in the darkroom.
14.3 Identify and demonstrate the procedures for exposing, flashing, and developing a halftone.	14.3.1 List the steps in producing a halftone. 14.3.2 Teacher evaluation of student work.
14.4 Describe and demonstrate the use of the transmission-reflection densitometer.	14.4.1 What is the use of the transmission reflection densitometer? 14.4.2 Teacher evaluation of student operational procedures in using the transmission-reflection densitometer.
14.5 Describe and demonstrate the procedures for setting press cylinders (plate, blanket, impression) to print halftones.	14.5.1 List the steps in setting press cylinders to print halftones. 14.5.2 Teacher evaluation of student work.

VOCATIONAL EDUCATION
INDUSTRIAL ARTS EDUCATION

Grade Level: 10-12 Skills/Subject Area: Graphic Arts Technology

COMPETENCY GOAL 15: The learner will describe and demonstrate the principles of screen tint in printing.

Objectives	Measures
15.1 Describe the industrial application of screen tint printing including overprints and reverses.	15.1.1 What are some industrial applications of screen tint printing?
15.2 Identify and demonstrate the methods of lithographic plate production incorporating screen tints, reverses, and overprints.	15.2.1 Describe the process for incorporating each of the following in lithographic plate production: a. screen tint b. reverses c. overprints 15.2.2 Teacher evaluation of student work.
15.3 Describe and demonstrate the procedures for adjusting offset press dampening and ink form rollers to print screen tints.	15.3.1 Make adjustments in ink and dampening rollers in order to print screen tint. 15.3.2 Teacher evaluation of student work.

Grade Level: 10-12 Skills/Subject Area: Graphic Arts Technology

COMPETENCY GOAL 16: The learner will describe and demonstrate the principles of duotone in printing.

Objectives	Measures
16.1 Describe the industrial application and use of fake and screen duotones in a printed product.	16.1.1 Discuss the use of duotones in printed products.
16.2 Identify and demonstrate the procedures of photographing a screen duotone.	16.2.1 List the steps in photographing a screen duotone.
	16.2.2 Teacher evaluation of student work.
16.3 Describe and demonstrate methods of eliminating moire in photography and platemaking.	16.3.1 How are moires eliminated in photography and platemaking?
	16.3.2 Teacher evaluation of student work.
16.4 Identify and demonstrate the various offset press adjustments necessary to obtain perfect registration, including paper feeding problems.	16.4.1 Teacher evaluation of student work.

VOCATIONAL EDUCATION
INDUSTRIAL ARTS EDUCATION

Grade Level: 10-12 Skills/Subject Area: Graphic Arts Technology

COMPETENCY GOAL 17: The learner will describe and demonstrate the application of photographic processes in screen printing.

Objectives	Measures
17.1 Identify the educational needs and occupational opportunities in the screen printing industry.	17.1.1 Refer to test item 5.2.1.
17.2 Describe the importance of screen process printing in our technological culture and identify screen printed products.	17.2.1 Describe the role of screen process printing in our technological culture and give ten examples of screen printed products.
17.3 Demonstrate the photographic silk screen printing procedure.	17.3.1 Teacher evaluation of student work.
17.4 Describe the various methods of incorporating cold type composition techniques and line photographic screen process, i.e., transfer and direct film emulsions.	17.4.1 Refer to test items 5.6.1 and 5.6.2.
17.5 Identify the techniques for manufacturing overlapping and non-overlapping posterizations, tone lines, reticulations, and bas reliefs for photographic screen reproduction.	17.5.1 Describe the techniques for manufacturing the following: a. overlapping posterization b. non-overlapping posterizations c. tone lines d. reticulations e. bas reliefs
17.6 Demonstrate darkroom safety practices.	17.6.1 Teacher observation of student safety practices in the darkroom.
17.7 Demonstrate the procedure for manufacturing a multiple color overlapping posterization.	17.7.1 Teacher evaluation of student work.

Skills/Subject Area: Graphic Arts Technology

COMPETENCY GOAL 17: The learner will describe and demonstrate the application of photographic processes in screen printing.

Objectives	Measures
17.8 Demonstrate the procedure for manufacturing a tone line.	17.8.1 Teacher evaluation of student work.
17.9 Demonstrate the procedure for manufacturing a reticulation.	17.9.1 Teacher evaluation of student work.
17.10 Demonstrate the procedure for manufacturing a bas relief.	17.10.1 Teacher evaluation of student work.
17.11 Demonstrate the procedure for manufacturing a multiple color non-overlapping posterization.	17.11.1 Teacher evaluation of student work.

VOCATIONAL EDUCATION
INDUSTRIAL ARTS EDUCATION

Grade Level: 10-12 Skills/Subject Area: Graphic Arts Technology

COMPETENCY GOAL 18: The learner will describe and demonstrate the application of photographic processes in offset lithography.

Objectives	Measures
18.1 Describe the importance of full or four-color printing as a part of the total graphic arts industry.	18.1.1 Discuss the importance of four-color printing in the graphic arts industry.
18.2 Identify the educational needs and occupational opportunities of the four-color photographer and printer.	18.2.1 Identify job opportunities for the four-color photographer and printer and describe levels of education needed for each job.
18.3 Describe the principles of color additives and color subtraction.	18.3.1 What is the principle of additive color?
18.4 Describe the use of filters in photography.	18.4.1 Why are filters used in photography?
18.5 Describe the basic principles of color separation.	18.5.1 Discuss the principles of color separation.
18.6 Describe direct and indirect method of color separation.	18.6.1 What is the direct method of color separation?
18.7 Identify safety practices in handling film and chemicals in the darkroom.	18.7.1 Refer to Test Item 14.2.1.
18.8 Identify and demonstrate one method of color separation.	18.8.1 Teacher evaluation of student work.
18.9 Describe and demonstrate controls for exposing and developing color separations.	18.9.1 Discuss the controls used in exposing and developing color separations.

Grade Level: 10-12

Skills/Subject Area: Graphic Arts Technology

COMPETENCY GOAL 18: The learner will describe and demonstrate the application of photographic processes in offset lithography.

Objectives	Measures
18.10 Identify and demonstrate registration methods necessary for stripping and manufacturing color separation offset plate.	18.10.1 How are separation negatives registered in the stripping process?
	18.10.2 Teacher evaluation of student work in stripping color separation negatives.
	18.10.3 How are separation negatives registered for the platemaking process?
18.11 Describe all press methods and systems in preparation of printing four-color separations, i.e., feeding,inking, dampening, impression, and registration.	18.11.1 Refer to Test Item 6.1.2.
18.12 Identify offset press safety procedures.	18.12.1 Refer to Test Item 6.6.2.
18.13 Describe the modern industrial systems, controls, and machines used today to produce four-color separations, i.e., computer-driven, laser scanning color separation machine and four-color unit perfecting web presses.	18.13.1 How do computers and lasers contribute to industrial production of color separations?

Manufacturing Technology Outline

1. Introduction to Manufacturing Technology

2. Related Career Information for Manufacturing Technology

3. Define the Technological System of Manufacturing

    a. Main essentials of manufacturing
    b. Key elements of manufacturing
    c. Impact of manufacturing on communities and countries

4. Design Process in the Technological System of Manufacturing

    a. Consumer demand effects on manufacturing
    b. Determining demand for products
    c. Process of research and development
    d. Steps of product design
    e. Function of technical manuals

5. Production Planning Process

    a. Steps in production planning
    b. Function of automation in manufacturing
    c. Product cost estimate
    d. Steps in the tooling-up process
    e. Production process (controlled)
    f. Elements of design and production of the product package

6. Production Process

7. Marketing Process in Manufacturing

    a. Elements of the marketing process
    b. Sales people in the marketing process

8. Operations and Management Process

    a. Steps for establishing a manufacturing company
    b. Factors in personnel management

9. Servicing Process in Manufacturing

    a. Function of service
    b. Judging serviceability

10. Chemical and Physical Characteristics of Common Raw Material/How Changes Necessary for the Raw Materials to be Useful Products

    a. Selection of materials utilized in the product
    b. Raw materials used in the production process
    c. Elements of the production process
    d. Hardwood and softwood
    e. Processing of wood
    f. Tools in woodworking
    g. Safe use of hand tools
    h. Safe use of power tools and equipment used in woodworking
    i. Safe use of power tools and equipment in metal manufacturing
    j. Knowledge of blueprint reading

VOCATIONAL EDUCATION
INDUSTRIAL ARTS EDUCATION

Grade Level: 9-12 Skills/Subject Area: Manufacturing Technology

COMPETENCY GOAL 1: The learner will describe the purpose and objectives of an industrial arts course in manufacturing technology.

Objectives	Measures
1.1 Describe the basic purpose and aim of industrial arts.	Refer to Competency/Test Item Book VEC-IAE-C 8100, pp. 7-11.
1.2 Identify common occupations within manufacturing.	
1.3 Identify specific requirements, training, salary ranges, and trends within all industrial arts areas of instruction.	
1.4 Demonstrate ability to work safely in the laboratory.	
1.5 Identify information necessary for safe operation of tools and equipment.	

VOCATIONAL EDUCATION
INDUSTRIAL ARTS EDUCATION

Grade Level: 9-12 Skills/Subject Area: Manufacturing Technology

COMPETENCY GOAL 2: The learner will relate career information about manufacturing with human knowledge, skills, abilities, and attitudes.

Objectives	Measures
2.1 Identify personal interests, and physical and mental abilities.	Refer to Competency/Test Item Book VEC-IAE-C 8100, pp. 12-30.
2.2 Identify possible career options consistent with abilities.	
2.3 Describe personal value system.	
2.4 Describe how value judgements affect lifestyle and career aspirations.	
2.5 Describe relationship between attitude and success in life and work.	
2.6 Describe the "transfer of skill" as it relates to tentative occupational choices.	
2.7 Analyze self in relation to industry and life situations.	
2.8 Use decision-making processes in solving technical problems and coping with life situations.	
2.9 Identify personal, educational, and financial requirements needed to achieve tentative career goals.	

Grade Level: 9-12

Skills/Subject Area: Manufacturing Technology

COMPETENCY GOAL 2: The learner will relate career information about manufacturing with human knowledge, skills, abilities, and attitudes.

Objectives	Measures
2.10 Identify high school instruction necessary in pursuing tentative career choices.	
2.11 Show pride in workmanship.	
2.12 Show desire to interact cooperatively with others.	
2.13 Describe the importance of dependable behavior in work and life situations.	
2.14 Display dependable behavior in work and life situations.	

VOCATIONAL EDUCATION
INDUSTRIAL ARTS EDUCATION

Grade Level: 9-12 Skills/Subject Area: Manufacturing Technology

COMPETENCY GOAL 3: The learner will describe the technological system of manufacturing and its impact on the society.

Objectives	Measures
3.1 Identify the main essentials of manufacturing technology (material resources, human resources, and capital resources).	Refer to Competency/Test Item Book VEC-IAE-C 8100, pp. 31-32.
3.2 Identify and define the key elements of manufacturing (product feasibility, product design, research and development, product tooling, production control, personal management, production, and marketing).	
3.3 Describe how the manufacturing industry meets human needs.	
3.4 Recognize the impact of the manufacturing industry on communities and countries.	

VOCATIONAL EDUCATION
INDUSTRIAL ARTS EDUCATION

Grade Level: 9-12 Skills/Subject Area: Manufacturing Technology

COMPETENCY GOAL 4: The learner will describe the design process in the technological system of manufacturing.

Objectives	Measures
4.1 Describe how consumer demand effects manufacturing.	Refer to Competency/Test Item Book VEC-IAE-C 8100, pp. 33-37.
4.2 Identify ways in which a manufacturer determines the demand for a product.	
4.3 Describe the process of research and development.	
4.4 Demonstrate the steps of product design.	
a. Demonstrate development of alternative solutions in the construction of models (e.g., refining solutions, selecting final designs, selecting material, making working drawings, building prototype).	
4.5 Describe the function of technical manuals.	

VOCATIONAL EDUCATION
INDUSTRIAL ARTS EDUCATION

Grade Level: 9-12 Skills/Subject Area: Manufacturing Technology

COMPETENCY GOAL 5: The learner will describe the production planning process in the technological system of manufacturing.

Objectives	Measures
5.1 Describe steps in production planning.	Refer to Competency/Test Item Book VEC-IAE-C 8100,
a. Determine processes and operation.	
b. Develop flow pattern.	
5.2 Describe function of automation in manufacturing.	
5.3 Describe ways in which work is measured and ways in which workers are paid.	
a. Demonstrate the process of time and motion study.	
b. List different types of pay systems.	
5.4 List the elements of product cost estimate.	
a. List materials cost, labor, overhead, and profit figures.	
b. Define "break even point" as it relates to product manufacturing.	

Skills/Subject Area: Manufacturing Technology

COMPETENCY GOAL 5: The learner will describe the production planning process in the technological system of manufacturing.

Objectives	Measures
5.5 Define and identify steps in the tooling-up process.	
a. Demonstrate the process of machine and tool selection.	
b. Identify the need for jigs and fixtures.	
c. Demonstrate the process of designing and building jigs and fixtures.	
5.6 Describe how the production process is controlled.	
a. Identify the elements of: (1) flow control (2) quality control (3) inventory control (4) production personnel management	
5.7 Identify the elements in the design and production of the product package.	
a. List the functions of a package	

Grade Level: 9-12 Skills/Subject Area: Manufacturing Technology

COMPETENCY GOAL 6: The learner will describe the production process in the technological system of manufacturing.

Objectives	Measures
6.1 Describe the differences between mass production and custom production.	Refer to Competency/Test Item Book VEC-IAE-C 8100, pp. 45-47.
6.2 Contrast the skill needed by a person doing custom as opposed to mass production. a. Participate in mass production. b. Participate in custom production activities.	

Grade Level: 9-12 Skills/Subject Area: Manufacturing Technology

COMPETENCY GOAL 7: The learner will describe the marketing process in the technological system of manufacturing.

Objectives	Measures
7.1 Describe the rationale and elements of the marketing process.	Refer to Competency/Test Item Book VEC-IAE-C 8100, pp. 48-49.
a. Identify the elements in preparing a sales forecast (e.g., survey of market, economic data gathering, analyzing information, predicting sales and profits).	
b. Identify the functions of an advertising campaign.	
c. Describe the function of a sales promotion.	
d. List the considerations in establishing a price.	
e. Describe the function of a product distribution system.	
f. List ways in which a product may be distributed.	
7.2 Describe the types of sales people in the marketing process.	

VOCATIONAL EDUCATION
INDUSTRIAL ARTS EDUCATION

Grade Level: 9-12 Skills/Subject Area: Manufacturing Technology

COMPETENCY GOAL 8: The learner will describe the operations and management process in the technological system of manufacturing.

Objectives	Measures
8.1 Identify considerations and steps for establishing a manufacturing company (purpose, ownership, financial).	Refer to Competency/Test Item Book VEC-IAE-C 8100, pp. 50-51.
a. Define proprietorship, partnership, corporation.	
b. Identify financing considerations (a. Stock, b. Promissory notes).	
8.2 Identify factors in personnel management.	
a. Describe the process for hiring and training workers.	
b. Describe the process of promoting and monitoring employees.	
c. Describe the union-management relationship.	
d. Develop a labor contract through collective bargaining and role playing.	

Grade Level: 9-12 Skills/Subject Area: Manufacturing Technology

COMPETENCY GOAL 9: The learner will describe the servicing process in the technological system of manufacturing.

Objectives	Measures
9.1 Define the function of servicing.	Refer to Competency/Test Item Book VEC-IAE-C 8100, pp. 52-53.
9.2 List factors that would be considered in judging the serviceability of a product.	
a. Describe the importance of the availability of service personnel and replacement parts, cost of service, support requirement for the product, and compatibility of the product with existing products.	

VOCATIONAL EDUCATION
INDUSTRIAL ARTS EDUCATION

Grade Level: 9-12 Skills/Subject Area: Manufacturing Technology

COMPETENCY GOAL 10: The learner will identify chemical and physical characteristics of common raw materials in the technological system of manufacturing and demonstrate the chemical and mechanical processes required to change raw materials into useful products.

Objectives	Measures
10.1 List the main characteristics to be considered when selecting the materials utilized in the product.	Refer to Competency/Test Item Book VEC-IAE-C 8100, pp. 54-135.
a. Describe the electrical, acoustical, aesthetic, mechanical, thermal, and chemical characteristics of a material in terms of its function in a product.	
10.2 Describe the factors necessary to best match the raw materials to the production process.	
a. Describe how stock sizes of materials affect the design of the product.	
b. Describe how stock sizes of materials affect the production process.	
10.3 Identify the elements of the production processes.	
a. List the processes used in combining and separating materials.	
b. List the processes used in shaping materials.	
c. List the processes used in assembling and finishing the product.	

Grade Level: 9-12

Skills/Subject Area: Manufacturing Technology

COMPETENCY GOAL 10: The learner will identify chemical and physical characteristics of common raw materials in the technological system of manufacturing and demonstrate the chemical and mechanical processes required to change raw materials into useful products.

Objectives	Measures
10.4 Visually distinguish between hardwoods and softwoods.	
10.5 Identify common hardwoods and common softwoods.	
10.6 Describe how wood is processed from raw stage to a usable product.	
10.7 Describe how wood is sized and sold to the consumer.	
10.8 Use layout tools in woodworking properly.	
10.9 Use hand saws safely and properly.	
10.10 Cut by a hand a dado, rabbet.	
10.11 Use a miter box safely and accurately.	
10.12 Use the coping saw safely and properly.	
10.13 Describe uses of the wood plane and wood chisel.	

Grade Level: 9-12

Skills/Subject Area: Manufacturing Technology

COMPETENCY GOAL 10: The learner will identify chemical and physical characteristics of common raw materials in the technological system of manufacturing and demonstrate the chemical and mechanical processes required to change raw materials into useful products.

Objectives	Measures
10.14 Use the wood plane and wood chisel safely and properly.	
10.15 Describe the types and uses of hand drills.	
10.16 Use hand drills safely and properly.	
10.17 Describe the types and uses of wood fasteners.	
10.18 Fasten wood together with hammer and screwdriver safely and properly.	
10.19 Describe the types and uses of common adhesives used in woodworking.	
10.20 Glue wood together using the proper procedures.	
10.21 Select and properly use abrasives (sandpaper) in finishing wood.	

Grade Level: 9-12

Skills/Subject Area: Manufacturing Technology

COMPETENCY GOAL 10: The learner will identify chemical and physical characteristics of common raw materials in the technological system of manufacturing and demonstrate the chemical and mechanical processes required to change raw materials into useful products.

Objectives	Measures
10.22 Describe common finishes that may be applied to wood.	
10.23 Properly apply finishes to wood.	
10.24 Describe the function and operation of the following power tools: jigsaw, bandsaw, drill press, circular saw, and jointer.	
10.25 Operate the following power tools in woodworking safely and properly: jigsaw, band saw, drill press, circular saw, and jointer.	
10.26 Use layout tools in metal properly.	

Skills/Subject Area: Manufacturing Technology

COMPETENCY GOAL 10: The learner will identify chemical and physical characteristics of common raw materials in the technological system of manufacturing and demonstrate the chemical and mechanical processes required to change raw materials into useful products.

Objectives	Measures
10.27 Use the following hand tools safely and properly: hacksaw, files, cold chisels, drills, punches, tap and die, and hand riveter.	
10.28 Describe how and where sheet metal products are used.	
10.29 Use the following sheet metal tools safely and properly: hammer, stakes, punches, groover, snips.	
10.30 Use the following sheet metal machines safely and properly: slip roll, bar folder, brake.	
10.31 Demonstrate proper methods of forming seams and hems in sheet metal.	
10.32 Describe the forging process and its use in industry.	
10.33 Use the forge, anvil, and hammer safely and properly.	
10.34 Draw and bend metal.	

Skills/Subject Area: Manufacturing Technology

COMPETENCY GOAL 10: The learner will identify chemical and physical characteristics of common raw materials in the technological system of manufacturing and demonstrate the chemical and mechanical processes required to change raw materials into useful products.

Objectives	Measures
10.35 Describe the "heat treatment" process and and why it is used.	
10.36 Anneal, harden, and temper metal.	
10.37 Describe the casting (foundry) process and where it is used.	
10.38 Identify and use properly the following casting tools to cast a finished product: patterns, flash, hammer, riddle, sprue pin, gate cutter.	
10.39 Explain why and describe how metals are machined.	
10.40 Use proper tools in machining, measuring, and layout.	
10.41 Use and read a micrometer properly.	
10.42 Demonstrate safe and proper process of grinding and drilling metal.	
10.43 Describe and compare the two major groups of plastics.	

Skills/Subject Area: Manufacturing Technology

COMPETENCY GOAL 10: The learner will identify chemical and physical characteristics of common raw materials in the technological system of manufacturing and demonstrate the chemical and mechanical processes required to change raw materials into useful products.

Objectives	Measures
10.44 Describe the major methods of forming thermoplastic materials.	
10.45 Design and construct a plaster mold for vacuum forming.	
10.46 Vacuum form a product.	
10.47 Produce a successful product by the dip method.	
10.48 Demonstrate safe and proper techniques for machining acrylics.	
10.49 Demonstrate safe and correct techniques of adhesive and solvent bonding acrylics.	
10.50 Describe how drawings are utilized by and in industry.	
10.51 Use tools of drawing (pencil, T-square, triangles) properly.	
10.52 Demonstrate techniques of orthographic projection.	
10.53 Develop an isometric drawing.	

Grade Level: 9-12 Page 8

Skills/Subject Area: Manufacturing Technology

COMPETENCY GOAL 10: The learner will identify chemical and physical characteristics of common raw materials in the technological system of manufacturing and demonstrate the chemical and mechanical processes required to change raw materials into useful products.

Objectives	Measures
10.54 Develop an oblique drawing.	
10.55 Define and describe use of a "section."	
10.56 Place dimensions accurately on drawings.	
10.57 Read and use engineer scale accurately.	
10.58 Describe the principles of design in relation to drawing and planning.	

Materials and Processing Outline

1. Introduction to Material Processing

2. Processing of

    a. Wood
    b. Metal
    c. Plastic

3. Testing the Properties of Materials

    a. Compare different properties of materials
    b. Methods of testing properties
        (1) physical
        (2) thermal
        (3) chemical
        (4) electrical

4. Describe Material Properties

    a. Wood
    b. Metal
    c. Plastic

5. Methods of Processing Materials

    a. Cohesion
    b. Adhesion
    c. Bonding (wood, metal, plastic)
    d. Adding materials

6. Removing Materials

    a. Cutting
    b. Shearing
    c. Redistributing
    d. Changing properties

7. Safety Working Habits

    a. Safety in the law
    b. Safety rules and precautions
    c. OSHA regulations

8. Using Appropriate Materials to Fabricate Usable Articles

9. Identification of Careers in Materials Processing

VOCATIONAL EDUCATION
INDUSTRIAL ARTS EDUCATION

Grade Level: 10-12 Skills/Subject Area: Materials and Processing

COMPETENCY GOAL 1: The learner will understand the various ways wood, metal, plastic, and other materials can be processed.

Objectives	Measures
1.1 Identify the basic reasons for studying materials processing.	1.1.1 Name one method for processing each of the materials listed below: a. wood b. metal c. plastic
1.2 Describe the development of the use of the various materials and processes and how this development has effected the growth of our industrial/technical society.	1.2.1 List at least three examples of the effects of processed materials on the growth of our industrial/technical society.
1.3 Read and produce working drawings for laboratory use.	1.3.1 Draw a set of working drawings and explain the various mechanical or architectural symbols used to complete the drawings.
1.4 Demonstrate ability in layout and measurement.	1.4.1 Layout and measure correctly a section of sheet metal to make a tray 2' x 5' x 10'.
1.5 Identify the steps in the scientific method and describe its importance to an industrial/technical society.	1.5.1 Outline the scientific procedure which could be used to solve a technical problem in the industrial arts lab that relates to an industrial/technical society.

VOCATIONAL EDUCATION
INDUSTRIAL ARTS EDUCATION

Grade Level: 10-12 Skills/Subject Area: Materials and Processing

COMPETENCY GOAL 2: The learner will identify methods of testing the properties of materials.

Objectives	Measures
2.1 Describe the importance of being able to discern the different properties of materials.	2.1.1 List several properties of the following materials: a. wood b. plastic c. metal
2.2 Compare the different properties of materials.	2.2.1 Name properties that are common to the following materials: a. wood b. plastic c. metal
2.3 Describe the methods of testing the physical, thermal, chemical, and electrical properties of materials.	2.3.1 Name one method of testing each of the properties of materials listed below: a. physical b. thermal c. chemical d. electrical
2.4 Test various materials for thermal conductivity, thermal expansion, compressive strength, tensile strength, impact strength, hardness, stress, ductility, malleability, chemical resistance, dielectric strength, dielectric constant, and ore resistance.	2.4.1 Explain the method used to test wood, metal, and plastic for thermal conductivity, compressive strength, tensile strength, impact strength, hardness, stress, ductility, malleability, chemical resistance, dielectric strength, dielectric constant, and ore resistance.
2.5 Use test date to form hypothesis as to the use of the tested materials.	2.5.1 Form a hypothesis as to the use of the dated tested materials.

VOCATIONAL EDUCATION
INDUSTRIAL ARTS EDUCATION

Grade Level: 10-12 Skills/Subject Area: Materials and Processing

COMPETENCY GOAL 3: The learner will describe the properties of wood.

Objectives	Measures
3.1 Describe the structure of wood.	3.1.1 Draw a cross section of a tree and identify the parts.
3.2 Explain the purposes of the outer bark, inner bark (phloem), cambrium layer, springwood, summerwood, growth ring, sapwood, heartwood, and pith.	3.2.1 What is the purpose of each: a. outer bark b. inner bark (phloem) c. cambrium layer d. springwood e. summerwood f. growth ring g. sapwood h. heartwood i. pith
3.3 Describe the cell structure of various woods.	3.3.1 What is the difference in cell structure between soft and hard woods?
3.4 Describe the effects of various moisture contents in woods and the results of uncontrolled or unequal moisture loss.	3.4.1 Give examples of what can happen to wood as a result of uncontrolled or unequal moisture loss.
3.5 Describe the processes involved in the manufacture of various wood products (e.g., turpentine, plywood, particle board).	3.5.1 Develop a chart that will demonstrate the processes involved in the manufacture of plywood or turpentine.

Grade Level: 10-12 Skills/Subject Area: Materials and Processing

COMPETENCY GOAL 4: The learner will describe the structure of metal.

Objectives		Measures	
4.1	Describe the production of various ferrous and nonferrous metals (e.g., iron, steel, copper, aluminum, various alloys).	4.1.1	Draw a flow chart describing the production sequence for various ferrous and nonferrous metals. Also demonstrate how the metal is processed into a useful metal.
4.2	Describe the basic methods of processing metals into useful products (e.g., rolling, forging, extruding, and casting).	4.2.1	Draw a flow chart describing the production sequence for various ferrous and nonferrous metals. Also demonstrate how the metal is processed into a useful metal.
4.3	Describe the grain and crystalline structure of metals.	4.3.1	Draw a chart test which can demonstrate grain and crystalline structure of metals.
4.4	Identify unknown metals using established practices (i.e., spark tests, chemical tests, designation systems, hardness tests, specific gravity).	4.4.1	Identify at least three unknown metals using any of the established practices.

VOCATIONAL EDUCATION
INDUSTRIAL ARTS EDUCATION

Grade Level: 10-12 Skills/Subject Area: Materials and Processing

COMPETENCY GOAL 5: The learner will describe the structure of plastic (synthetic).

Objectives		Measures	
5.1	Describe the production of plastic resins.	5.1.1	Draw a chart which can demonstrate the production of plastic resins.
5.2	Test and identify various thermoplastic and thermosetting resins.	5.2.1	Thermosetting resins can be treated and formed into another shape: True or False?
5.3	Describe the properties of at least six plastic resins (three thermoplastic and three thermosetting).	5.3.1	Write three properties of thermoplastic and three properties of thermosetting.

Grade Level: 10-12 Skills/Subject Area: Materials and Processing

COMPETENCY GOAL 6: The learner will describe the structure of plastic (non-synthetic).

Objectives	Measures
6.1 Describe the production, composition, properties, and uses of glass.	6.1.1 Draw a chart to demonstrate the following: a. production of glass b. types of glass c. properties of glass d. uses of glass
6.2 Describe the production, properties, and uses of cement and concrete.	6.2.1 Draw a chart to demonstrate the following: a. production of cement and concrete b. properties of cement and concrete c. uses of cement and concrete
6.3 Describe the production, properties, and uses of ceramic materials.	6.3.1 Draw a chart to demonstrate the following: a. production of ceramic materials b. properties of ceramic materials c. uses of ceramic materials

VOCATIONAL EDUCATION
INDUSTRIAL ARTS EDUCATION

Grade Level: 10-12 Skills/Subject Area: Materials and Processing

COMPETENCY GOAL 7: The learner will identify methods of processing materials.

Objectives	Measures
7.1 Describe the principle and processes of adding material through heat: a. Cohesion: gas welding, arc welding, hot gas welding, and heat sealing. b. Adhesion: soldering and brazing.	7.1.1 Explain the methods of adding material by heat.
7.2 List and describe methods of mechanically fastening materials.	7.2.1 Explain the methods of adding material by mechanical fastening.
7.3 List and describe the principle of adding materials with adhesives (cold). a. Bonding wood: natural adhesives and synthetic adhesives. b. Bonding metal: thermoplastic adhesives, thermosetting adhesives, and elastomeric adhesives. c. Bonding plastic: reactive adhesives, bodies adhesives, elastomeric adhesives.	7.3.1 Explain the methods of adding material by bonding wood, metal, and plastic.

Skills/Subject Area: Materials and Processing

COMPETENCY GOAL 7: The learner will identify methods of processing materials.

Objectives	Measures
7.4 Describe the principle of cold cohesion (solvent welding).	7.4.1 Explain the methods of adding material by cold cohesion.
7.5 List and describe methods of adding material through coatings and treatments. a. Coatings: brushing, spraying, dipping, rolling, fluidized bed coating, electrostatic finishing, electroplating, anodizing. b. Treatments: stains and wood fillers.	7.5.1 Explain the methods of adding material by coatings and treatments.

VOCATIONAL EDUCATION
INDUSTRIAL ARTS EDUCATION

Grade Level: 10-12 Skills/Subject Area: Materials and Processing

COMPETENCY GOAL 8: The learner will demonstrate methods of removing materials.

Objectives	Measures
8.1 Describe different cutting edges and their purposes (e.g., straight edge, sharp-pointed edge, and formed edge).	8.1.1 Name three cutting edges and their use in removing materials.
8.2 Differentiate between cutting and shearing.	8.2.1 Explain how cutting materials differs from shearing materials.
8.3 Describe the principle of flame-cutting (oxyacetylene).	8.3.1 List steps involved in flame-cutting (oxyacetylene).
8.4 List and describe the processes of redistributing materials through heat forming.	8.4.1 Complete a project that illustrates the process of forging and another that illustrates casting.
8.5 List and describe the process of redistributing materials through pressure forming.	8.5.1 Draw five charts that illustrate the following processes: a. die casting (hot and cold) b. injection molding c. extrusion d. blow molding e. compression and transfer molding
8.6 List and describe the processes of changing a material's contour.	8.6.1 Identify tools and machines that bend and change the contour of machinery.
8.7 Describe the processes for changing the properties of a material.	8.7.1 Identify five heat treatment processes used in metal working (e.g., hardening, tempering, normalizing, annealing, and case hardening).

Skills/Subject Area: Materials and Processing

COMPETENCY GOAL 8: The learner will demonstrate methods of removing materials.

Objectives		Measures	
8.8	Explain why these processes can be happening simultaneously to a material undergoing machine or tool operations.	8.8.1	Explain through charts how the processes in 8.7.1 react in different metal types (simultaneously to a material undergoing machine or tool operations).

Grade Level: 10-12 Skills/Subject Area: Materials and Processing

COMPETENCY GOAL 9: The learner will demonstrate safe working habits.

Objectives		Measures	
9.1	Demonstrate safe work habits in the laboratory.	9.1.1	Pass all safety tests 90% or better.
9.2	Explain the reasons for safety rules and precautions.	9.2.1	Draw at least two safety posters for the lab to demonstrate the reasons for safety.
9.3	Demonstrate an ability to research and decipher OSHA safety rules concerning different materials and processes.	9.3.1	Use the OSHA safety rules and design a safe welding area.

Grade Level: 10-12 Skills/Subject Area: Materials and Processing

COMPETENCY GOAL 10: The learner will demonstrate understanding of using appropriate materials to fabricate usable articles.

Objectives	Measures
10.1 Construct usable articles using the most appropriate materials and processes for the given technical problem within acceptable quality standards.	10.1.1 Construct a computer desk using appropriate materials which will hold a personal computer, printer, monitor, and interface unit. 10.1.2 Fill in the chart tracing industrialism in the Western World.

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Grade Level: 10-12 Skills/Subject Area: Materials and Processing

COMPETENCY GOAL 11: The learner will identify careers in materials processing.

Objectives	Measures
11.1 Identify the duties, responsibilities, main job requirements, and training for possible career options in materials processing.	11.1.1 List the duties, responsibilities, main job requirements and training for at least three careers related to materials processing.
11.2 Identify personal interests, physical characteristics, aptitudes needed for each career option.	11.2.1 List personal interests, physical characteristics, aptitudes, and mental abilities needed for each career listed in 11.1.1.
11.3 Describe the transfer of skills' process as it relates to possible materials processing career goals.	11.3.1 Identify several skills that can be transferred from the learning experience in the lab to the careers listed in 11.1.1.
11.4 Discuss how values affect lifestyles and career development aspects.	11.4.1 Illustrate several examples of how values will affect lifestyles and occupational choices.
11.5 Apply a decision-making process in choosing an occupation.	11.5.1 Draw a chart illustrating the decision-making process for choosing an occupation.
11.6 List financial requirements for achieving tentative career goals.	11.6.1 List several publications that provide information related to the financial requirements for achieving a tentative career goal.
11.7 List the desirable employee traits and work habits (e.g., dependability, cooperation, pride in work, integrity).	11.7.1 Demonstrate desirable employee traits and work habits.

Grade Level: 10-12

Skills/Subject Area: Materials and Processing

COMPETENCY GOAL 11: The learner will identify careers in materials processing.

Objectives	Measures
11.8 List materials processing training and educational opportunities at the public schools post-secondary, and college and university levels.	11.8.1 Identify training and educational opportunities for materials processing careers.

Metals Technology Outline

1. Introduction to Metals Technology

    a. Exploring metal technology occupations
    b. Physical characteristic
    c. Societal impact

2. Mining and Refining Metals

3. Safety in Metal Technology Lab

4. Measuring and Layout Tools

    a. Choice of materials
    b. Measuring sheet stock
    c. Measuring heavy stock
    d. Metric measurement

5. Design

    a. Requirement for design
    b. Principle of design
    c. Design analysis method

6. Drawing and Sketching

    a. Kinds of drawings
    b. The alphabet of lines
    c. Dimensions
    d. Scale

7. Developing and Transferring Patterns

    a. Transfer fluids
    b. Pattern development methods
    c. Enlarging a pattern

8. Cutting Heavy Metal

    a. Hand hacksaw
    b. Power hacksaw
    c. Cold chisel
    d. Throatless shears
    e. Slitting shears

9. Cutting Sheet Metal
    a. Hand snips
    b. Tin snips or hand shears
    c. Squaring shears
    d. Jeweler's saw
    e. Punches

10. Drilling
    a. Drilling machines and equipment
    b. Grinding a drill
    c. Drilling

11. Use of Various Metals
    a. Ferrous and nonferrous metals
    b. Hot rolled and cold rolled metals
    c. Production process for manufacturing iron and steel

12. Tools for Equipment Related to Metals Industries
    a. Tools for holding work to drilling machines
    b. Reamers
    c. Taps and dies

13. Fitting and Assembly
    a. Safe and proper use of vises, clamps, and pliers
    b. Riveting metal together

14. Hot Metal Processes in Industry
    a. Soldering and brazing
    b. Arc welding
    c. Oxyacetylene welding
    d. Hand forging
    e. Heat treating
    f. Hot (poured) metal

15. Tool Care in the School and Industrial Setting

16. Finishing and Inspecting Processes Used in Industry
    a. Buffing process
    b. Applying finish to metal
    c. Quality control

17. Machine Tools Used in Metal Industry

    a. Metal lathe
    b. Metal shapes
    c. Milling machines (horizontal and vertical)

Grade Level: 10-12 Skills/Subject Area: Metals Technology

COMPETENCY GOAL 1: The learner will identify the objectives of the industrial arts course called Metals Technology.

Objectives	Measures
1.1 Describe the major objectives of the instructional program.	1.1.1 What are the major objectives of metals technology?

VOCATIONAL EDUCATION
INDUSTRIAL ARTS EDUCATION

Grade Level: 10-12 Skills/Subject Area: Metals Technology

COMPETENCY GOAL 2: The learner will relate career information about metals technology with human knowledge, skills, abilities, and attitudes.

Objectives		Measures	
2.1	Identify personal interests, physical characteristics, aptitudes, and mental abilities.	2.1.1	Using the headings listed below, identify your unique strengths: a. personal interests b. physical characteristics c. aptitudes d. mental abilities
2.2	Identify possible career options consistent with abilities and aptitudes.	2.2.1	List three possible careers in metal industries that fit your abilities and aspirations.
2.3	Describe how value judgements affect lifestyles and career aspirations.	2.3.1	Explain how value judgements can effect your lifestyles and career aspirations.
2.4	Describe relationship between attitude and success in life and work.	2.4.1	Describe the relationship between attitude and success in life and work.
2.5	Describe the "transfer of skill" as it relates to tentative occupational career goals.	2.5.1	Describe "transfer of skill" as it applies to tentative occupational career goals.
2.6	Use decision-making processes in making occupational choices.	2.6.1	Choose an occupation and demonstrate how you use the decision-making process to determine if you should consider employment.
2.7	Identify educational and financial requirements for achieving tentative career goals.	2.7.1	Identify a tentative career goal and describe the education and financial requirement.

Grade Level: 10-12 Page 2

Skills/Subject Area: Metals Technology

COMPETENCY GOAL 2: The learner will relate career information about metals technology with human knowledge, skills, abilities, and attitudes.

Objectives	Measures
2.8 List a cluster of occupations.	2.8.1 Name a cluster of occupations in the metals industries.
2.9 Identify desirable employee traits and work habits (e.g., dependability, cooperation, pride in work).	2.9.1 List the desirable traits that an employer looks for in an employee.
2.10 List training opportunities at the high school, post-secondary, and college or university level.	2.10.1 Training opportunities to meet career goals are available at: a. high school b. post-secondary c. college/university Identify the types of jobs available as a result of each kind of training.

Grade Level: 10-12 Skills/Subject Area: Metals Technology

COMPETENCY GOAL 3: The learner will know and understand metal working hand-tool operations.

Objectives	Measures
3.1 Use metal hand saws safely and correctly.	3.1.1 Teacher evaluation of student's proper use of metal hand saws safely and correctly.
3.2 Use the power hacksaw safely and correctly.	3.2.1 Teacher evaluation of student's proper use of the power hacksaw safely and correctly.
3.3 Identify and describe uses of cold chisels and files.	3.3.1 List and describe the four different file "cuts" and their uses.
3.4 Use cold chisels and files safely and accurately.	3.4.1 Teacher evaluation of student's safe and accurate use of cold chisels and files.
3.5 Identify abrasives used in metal working.	3.5.1 List and describe three types of abrasives commonly found in the metal working laboratory.
3.6 Select and properly use abrasives on metal.	3.6.1 Teacher evaluation of student's selection of and proper use of abrasives on metal.

VOCATIONAL EDUCATION
INDUSTRIAL ARTS EDUCATION

Grade Level: 10-12 Skills/Subject Area: Metals Technology

COMPETENCY GOAL 4: The learner will appreciate metal types, uses of various metals, machining operations, tools, and equipment related to metals industries.

	Objectives		Measures
4.1	Describe the differences between ferrous and nonferrous metals.	4.1.1	Explain the differences between ferrous and nonferrous metals.
4.2	Define "hot rolled" or "cold rolled" metals.	4.2.1	Explain the process of forming hot rolled metals.
4.3	Describe the difference between iron and steel.	4.3.1	Cite the element that differentiates steel from iron.
4.4	Describe the production process for manufacturing iron and steel.	4.4.1	Describe the process of refining iron ore to iron.
4.5	Explain the purpose of using lubricants in the metal machining processes.	4.5.1	Cite two purposes of lubricants in metal machining processes.
4.6	Identify common types of lubricants and describe where each is used in metal working.	4.6.1	Select proper lubricants for thread cutting, machining, and lubricating. (teacher observation)
4.7	Cite what machining operations are done on the drill press.	4.7.1	Describe four basic operations performed on the drill press.
4.8	Define "drilling."	4.8.1	Explain the basic principles of the drilling operation.
4.9	Describe how drills are sized.	4.9.1	Cite and explain the four sizing systems for drills.

Skills/Subject Area: Metals Technology

COMPETENCY GOAL 4: The learner will appreciate metal types, uses of various metals, machining operations, tools, and equipment related to metals industries.

Objectives	Measures
4.10 Identify the main types of drills.	4.10.1 Teacher evaluation of student's selection of appropriate type drill for particular operation.
4.11 Describe how a drill is sharpened.	4.11.1 Describe the angles and methods involved in sharpening a drill.
4.12 Identify several drilling machines.	4.12.1 Correctly match the following names of drilling machines to the appropriate machine. a. gang b. multiple spindle-turrettype c. radialarm d. sensitive drill press e. upright drilling machine
4.13 Utilize several methods of holding work to drilling machines (e.g., T-Bolts, V-Blocks, C-Clamps, Drill Vice, Drilling).	4.13.1 Teacher evaluation of student's proper use of hold down devices.
4.14 Use drilling procedures safely and properly.	4.14.1 Teacher evaluation of student using drilling procedures safely and properly.
4.15 Use reamers properly.	4.15.1 Teacher evaluation of student using reamers properly.

Grade Level: 10-12

Skills/Subject Area: Metals Technology

COMPETENCY GOAL 4: The learner will appreciate metal types, uses of various metals, machining operations, tools, and equipment related to metals industries.

Objectives	Measures
4.16 Use the following processes: a. counterboring b. countersinking c. spotfacing	4.16.1 Teacher evaluation of student counter boring. 4.16.2 Teacher evaluation of student counter sinking. 4.16.3 Teacher evaluation of student spotfacing.
4.17 Demonstrate the proper use of taps and dies to produce screw threads.	4.17.1 Teacher evaluation of student properly producing screw threads with taps and dies.
4.18 Distinguish between the following thread forms: UNF, UNC, ACME, Pipe.	4.18.1 Describe, in writing, UNF thread forms and uses. 4.18.2 Describe, in writing, UNC thread forms and uses. 4.18.3 Describe, in writing, ACME thread forms and uses. 4.18.4 Describe, in writing, Pipe thread forms and uses.

VOCATIONAL EDUCATION
INDUSTRIAL ARTS EDUCATION

Grade Level: 10-12 Skills/Subject Area: Metals Technology

COMPETENCY GOAL 5: The learner will understand fitting and assembly procedures.

Objectives		Measures	
5.1	Demonstrate safe and proper use of fitting and assembly tools (e.g., vises, clamps, pliers, screwdrivers, wrenches).	5.1.1	Teacher evaluation of students' safe and proper use of fitting and assembly tools (vises, clamps, pliers, screwdrivers, wrenches).
5.2	Demonstrate proper method of riveting metal together.	5.2.1	Teacher evaluation of student properly riveting metal together.
5.3	Demonstrate proper and safe method of removing rivets.	5.3.1	Teacher evaluation of student removing rivets.

VOCATIONAL EDUCATION
INDUSTRIAL ARTS EDUCATION

Grade Level: 10-12 Skills/Subject Area: Metals Technology

COMPETENCY GOAL 6: The learner will demonstrate an understanding of and an ability to work with sheet metal.

Objectives	Measures
6.1 Identify common sheet metal types and gauge thickness.	6.1.1 Label samples of various sheet metal correctly.
	6.1.2 Teacher observation and evaluation of student's proper use of sheet metal gauge.
6.2 Use proper method of cutting sheet metal with snips, shears, and saw.	6.2.1 Teacher observation and evaluation of student.
6.3 Operate the barfolder and brake properly in making a single hem, double hem, open fold, wired edge, grooved seam, folded corner.	6.3.1 Teacher evaluation operating the barfolder to properly make a single hem, double hem, open fold, wired edge, grooved seam, folded corner.
6.4 Use slip roll forming machine properly and safely.	6.4.1 Teacher evaluation of student's safe and proper use of slip roll forming machine.

VOCATIONAL EDUCATION
INDUSTRIAL ARTS EDUCATION

Grade Level: 10-12 Skills/Subject Area: Metals Technology

COMPETENCY GOAL 7: The learner will understand place of hot metal processes in industry.

Objectives	Measures
7.1 Demonstrate safe and proper method of soldering and brazing.	7.1.1 Teacher observation and evaluation of student's safe and proper soldering technique.
	7.1.2 Teacher observation and evaluation of student's safe and proper brazing technique.
7.2 Demonstrate safe and proper method or arc welding.	7.2.1 Teacher observation and evaluation of student's set up of welder, welding technique, and observation of arc welding safety rules.
7.3 Demonstrate safe and proper method of oxyacetylene welding.	7.3.1 Teacher observation and evaluation of student's set up of oxyacetylene welding equipment and subsequent safe method of welding--forehand and backhand.
7.4 Demonstrate proper technique of hand forging.	7.4.1 Teacher observation and evaluation of student demonstrating hand forging technique.
7.5 Describe the purposes and methods of heat treating metal.	7.5.1 Define the following: gardening, annealing, normalizing, tempering, hardness, toughness, ductility.

Grade Level: 10-12

Skills/Subject Area: Metals Technology

COMPETENCY GOAL 7: The learner will understand place of hot metal process in industry.

Objectives	Measures
7.6 Demonstrate safe and proper method for hot (poured) metal.	7.6.1 Written explanation of purposes for heat treating.
	7.6.2 Teacher observation and evaluation of student demonstration of safe and proper method of: a. ramming mold b. cutt runners, gates, and sprues c. firing furnace d. pouring mold e. breaking mold

Grade Level: 10-12 Skills/Subject Area: Metals Technology

COMPETENCY GOAL 8: The learner will appreciate the need for tool care in the school and industrial setting.

Objectives	Measures
8.1 Describe safe and proper method of mounting and using grinding wheels.	8.1.1 Written explanation of method of testing and mounting grinding wheel.
	8.1.2 Teacher observation and evaluation of student's mounting and use of grinding wheels.
8.2 Use safe and proper method of sharpening tools (chisels, tool, and drill bits).	8.2.1 Teacher observation and evaluation of student sharpening tools on grinding wheels (e.g., chisels, tool, and drill bits).

VOCATIONAL EDUCATION
INDUSTRIAL ARTS EDUCATION

Grade Level: 10-12 Skills/Subject Area: Metals Technology

COMPETENCY GOAL 9: The learner will understand the finishing and inspecting processes used in industry.

Objectives		Measures	
9.1	Describe the purpose of the buffing process.	9.1.1	Orally, or in writing, explain the purpose for buffing.
9.2	Describe how to clean various metals for finishing.	9.2.1	Orally, or in writing, explain the methods used to clean various metals for finishing.
9.3	Apply finish to metal properly.	9.3.1	Teacher observation and evaluation student properly applying finish to metal.
9.4	Describe the process for conducting quality control in the metals industries (e.g., inspection, measurements, and gauging tools).	9.4.1	Teacher evaluation of discussion with student.
		9.4.2	Match gauging tool descriptions with pictures of same.

VOCATIONAL EDUCATION
INDUSTRIAL ARTS EDUCATION

Grade Level: 10-12 Skills/Subject Area: Metals Technology

COMPETENCY GOAL 10: The learner will demonstrate an understanding of the machine tools used in the metals industries.

Objectives	Measures
10.1 Operate the metal lathe in selected operations safely and properly.	10.1.1 Teacher evaluation and observation of student operating lathe safely and properly in order to: turn between centers, bore, face, knurl, drill ream, turn tapers, and cut threads.
10.2 Operate the metal shaper safely and properly.	10.2.1 Teacher observation and evaluation of student operating metal shaper safely and properly.
10.3 Operate the milling machine (horizontal and vertical) safely and properly.	10.3.1 Teacher observation and evaluation of student operation of horizontal and vertical milling machines in safe and proper fashion.

Plastics Technology Outline

1. Introduction

2. Career Information

3. Safety

4. Chemical and Physical Properties of Plastic Materials

   a. Major groups of plastic
   b. Thermoset or thermoplastic

5. Forming Material into Usable Product

   a. Major methods of forming thermoplastic material
   b. Vacuum forming
   c. Casting
   d. Filler material
   e. Acrylic polymers

VOCATIONAL EDUCATION
INDUSTRIAL ARTS EDUCATION

Grade Level: 10-12 Skills/Subject Area: Plastics Technology

COMPETENCY GOAL 1: The learner will identify the objectives of an industrial arts course in plastics technology.

Objectives	Measures
1.1 Describe the major objectives of the instructional program.	1.1.1 Identify the objectives of the industrial arts course, Plastics Technology.

VOCATIONAL EDUCATION
INDUSTRIAL ARTS EDUCATION

Grade Level: 10-12 Skills/Subject Area: Plastics Technology

COMPETENCY GOAL 2: The learner will relate career information about plastics technology with human knowledge, skills, abilities, and attitudes.

Objectives	Measures
2.1 Identify personal interests, physical characteristics, aptitudes, and mental abilities.	2.1.1 Using the headings listed below, identify your unique strengths: a. personal interests b. physical characteristics c. aptitudes d. mental abilities
2.2 Identify possible career options consistent with abilities and aptitudes.	2.2.1 List three possible careers in plastics that fit your abilities and aspirations.
2.3 Describe how value judgements affect lifestyles and career aspirations.	2.3.1 Explain how value judgements can affect your lifestyles and career aspirations.
2.4 Describe the relationship between attitude and success in life and work.	2.4.1 Describe the relationship between attitude and success in life and work.
2.5 Describe the "transfer of skill" as it relates to tentative occupational career goals.	2.5.1 Describe "transfer of skill" as it applies to tentative occupational career goals.
2.6 Use decision-making processes in making occupational choices.	2.6.1 Choose an occupation in plastics and demonstrate how you use the decision-making process.

Grade Level: 10-12

Skills/Subject Area: Plastics Technology

COMPETENCY GOAL 2: The learner will relate career information about plastics technology with human knowledge, skills, abilities, and attitudes.

Objectives	Measures
2.7 Identify educational and financial requirements for achieving tentative career goals.	2.7.1 Identify a tentative career goal and describe the education and financial requirements.
2.8 List a cluster of occupations in plastics.	2.8.1 Name a cluster of occupations in plastics.
2.9 Identify desirable employee traits and work habits (e.g., dependability, cooperation, pride in work).	2.9.1 List the traits of a good employee.
2.10 List training opportunities at the high school, post-secondary, and college or university level.	2.10.1 Identify the types of jobs one might expect as a result of: a. high school training b. post-secondary training c. college or university training

VOCATIONAL EDUCATION
INDUSTRIAL ARTS EDUCATION

Grade Level: 10-12 Skills/Subject Area: Plastics Technology

COMPETENCY GOAL 3: The learner will describe chemical and physical properties of plastic materials.

Objectives		Measures	
3.1	Describe and compare the two major groups of plastics.	3.1.1	Explain the differences in the molecular structure of thermoplastic polymers and thermoset (cross-linking) polymers.
3.2	Describe and classify a minimum of ten samples of plastics materials as thermostet or thermoplastic by match or heat test.	3.2.1	Evaluation of student work by instructor.
3.3	Describe a minimum of two characteristics and applications of 10 resins.	3.3.1	Give the characteristics and use of the following: polyproplyene resin, vinyl resin, styrene resin, polycarbonate resin, cellulosic resins, acrylic resins, nylon resins, acetal resins, polyurethane resins, and phenoxy resins.
3.4	Describe or list the common additives in plastics materials and the changes affected in the plastics materials.	3.4.1	The principle elements in plastics are carbon, nitrogen, oxygen, hydrogen, chlorine, and flouride. Show the material symbol, valence bond, and diagram shape of each element.

Grade Level: 10-12 Skills/Subject Area: Plastics Technology

COMPETENCY GOAL 4: The learner will describe and demonstrate chemical and physical means of forming plastic material into usable products.

Objectives	Measures
4.1 Describe the major methods of forming thermoplastic materials.	4.1.1 Describe the following processes: infection molding, extrusion, blow molding, thermoforming sheet materials.
4.2 Describe the types of tooling required for thermoforming of sheet thermoplastic materials.	4.2.1 Sketch or describe a mold to be used for thermoforming (vacuum) a serving tray as used in food service.
4.3 Thermoform a product by the free form method.	4.3.1 Evaluation of student work by instructor.
4.4 Design and construct a plaster mold for vacuum forming.	4.4.1 Evaluation of student work by instructor.
4.5 Vacuum form a product from a student designed mold.	4.5.1 Evaluation of student work by instructor.
4.6 Describe and compare the coating processes and identify industrial applications.	4.6.1 Describe the following methods of metal coating: plastisol dipping, fluidized bed process.
4.7 Produce a successful product by the dip method.	4.7.1 Evaluation of student work by instructor.
4.8 Produce a successful product by the fluidized bed process.	4.8.1 Evaluation of student work by instructor.

Grade Level: 10-12

Skills/Subject Area: Plastics Technology

COMPETENCY GOAL 4: The learner will describe and demonstrate chemical and physical means of forming plastic material into usable products.

Objectives	Measures
4.9 Describe the casting processes and identify industrial applications.	4.9.1 Explain the process and give application examples of: casting foam, polyester resin casting, plastisol molding.
	4.9.2 Explain how a casting resin is used to make furniture parts.
4.10 Successfully cast an embedment in casting resin.	4.10.1 Evaluation of student work by instructor.
4.11 Successfully cast a product in polyester resin using filler materials.	4.11.1 Evaluation of student work by instructor.
4.12 Describe the properties of acrylic polymers and their industrial applications.	4.12.1 Describe the general properties of acrylic tubing.
	4.12.2 What is the low and high melting points of acrylics?
	4.12.3 List five items made from acrylics.
	4.12.4 Describe the scratch resistance of an acrylic sheet.
4.13 Perform correct layout techniques for acrylics.	4.13.1 Evaluation of student work by instructor.
4.14 Demonstrate techniques of cutting acrylics safely and correctly.	4.14.1 Evaluation of student work by instructor.

Grade Level: 10-12

Skills/Subject Area: Plastics Technology

COMPETENCY GOAL 4: The learner will describe and demonstrate chemical and physical means of forming plastic material into usable products.

Objectives	Measures
4.15 Demonstrate correct and safe techniques of drilling acrylics.	4.15.1 Evaluation of student work by instructor.
4.16 Demonstrate techniques of mechanical fastening of acrylics safely and correctly.	4.16.1 Evaluation of student work by instructor.
4.17 Demonstrate techniques for forming acrylics by heating and bending safely and correctly.	4.17.1 Evaluation of student work by instructor.
4.18 Demonstrate techniques of adhesive and solvent bonding of acrylics safely and correctly.	4.18.1 Evaluation of student work by instructor.
4.19 Describe the types of solvents and applications for joining acrylics.	4.19.1 Give the trade name of two solvents used for joining acrylics.
4.20 Describe the processes used in reinforced plastic resins and their industrial applications.	4.20.1 Explain the processes used in reinforced plastics.
	4.20.2 Describe the purposes of resin and fiberglass.
	4.20.3 Explain the difference in the appearance and use of woven mat and random mat fiberglass.
	4.20.4 Explain how chopped glass fibers are used with resin.

Skills/Subject Area: Plastics Technology

COMPETENCY GOAL 4: The learner will describe and demonstrate chemical and physical means of forming plastic material into usable products.

Objectives	Measures
4.21 Describe the reactions of resin and catalyst and identify safe handling procedures.	4.21.1 What is the purpose of the catalyst added to the resin prior to application. 4.21.2 What safety measures should one use when handling the catalyst for plastic resin?
4.22 Produce a product in polyester resin in an open mold.	4.22.1 Evaluation of student work by instructor.
4.23 Describe the use of "gel coats."	4.23.1 Explain when the "gel coat" is applied in making plastic laminates. 4.23.2 What is the purpose of the "gel coat" in making plastic laminates?
4.24 Describe the types of molds for polyester resins and and their preparation.	4.24.1 Explain how the following molds are used in molding reinforced plastic: matched mold, open mold.
4.25 Describe the various types of release agents and their applications.	4.25.1 Explain the use of: film, film forming, lubricant, powder parting agent.
4.26 Produce a product by the matched mold process.	4.26.1 Evaluation of student work by instructor.

Skills/Subject Area: Plastics Technology

COMPETENCY GOAL 4: The learner will describe and demonstrate chemical and physical means of forming plastic material into usable products.

Objectives	Measures
4.27 Describe the expandable bead process and industrial applications.	4.27.1 Explain the use of expandable beads and describe industrial applications of expandable beads.
4.28 Produce a product utilizing expandable beads.	4.28.1 Evaluation of student work by instructor.

Technical Drawing and Planning Outline

1. Introduction to Technical Drawing and Planning

2. Career Information for Technical Drawing and Planning

3. Sketching and Simplest Visual Communication Technique

   a. Basic sketching fundamentals
   b. Acceptable sketching technique
   c. Sketch of multiview drawing

4. Mechanical Aids in Producing Accurate Visual Interpretation

5. Construction of Geometric Figures

6. Practical Applications of Precision Drawings in Visual Communications Process

   a. Multiview drawings
   b. Lines, symbols, dimensions
   c. Rules for dimensioning
   d. Pictorial drawing
      (1) isometric
      (2) oblique
      (3) perspective
   e. Sectional views
   f. Auxiliary views
   g. Revolutions

7. Surface Development

   a. Classes of surface development
   b. Parallel lines
   c. Cylinders
   d. Patterns for a two-piece elbow
   e. Patterns for a truncated circular cone
   f. Intersection of a cylinder with a cone

8. Manufacturing Processes in Technical Drawing and Planning

   a. Define manufacturing processes
      (1) spot face
      (2) counter bore
      (3) counter sink
      (4) counter drill
      (5) ream
      (6) broach

    (7) chamber
    (8) hone
    (9) grind
b. Cams and gears
c. Fasteners (screws and bolts)

VOCATIONAL EDUCATION
INDUSTRIAL ARTS EDUCATION

Grade Level: 10-12

Skills/Subject Area: Technical Drawing and Planning

COMPETENCY GOAL 1: The learner will identify the purpose and objectives of an industrial arts course in technical drawing.

Objectives	Measures
1.1 Describe the basic purpose and aims of technical drawing and planning.	1.1.1 What are the purposes of the industrial arts course called technical drawing and planning?
1.2 Describe the role of drafting in work situations.	1.2.1 What is the purpose of technical drawing in work situations?
1.3 Distinguish the differences between technical and architectural drawing.	1.3.1 What are the differences between technical and architectural drawing?
1.4 Describe the major objectives of technical drawing and planning	1.4.1 What are the objectives of the course technical drawing and planning?

VOCATIONAL EDUCATION
INDUSTRIAL ARTS EDUCATION

Grade Level: 10-12

Skills/Subject Area: Technical Drawing and Planning

COMPETENCY GOAL 2: The learner will relate career information about technical drawing with human knowledge, skills, abilities, and attitudes.

Objectives	Measures
2.1 Identify personal interests, physical characteristics, aptitudes, and mental abilities.	2.1.1 Identify your strengths in the following areas: a. personal interests b. physical characteristics c. aptitudes d. mental abilities
2.2 Identify possible career options consistent with abilities and aptitudes.	2.2.1 List three possible careers in technical drawing that fit your abilities and aspirations.
2.3 Describe how value judgements affect lifestyles and career aspirations.	2.3.1 Explain how value judgments can affect your life and career aspirations.
2.4 Describe relationship between attitude and success in life and work.	2.4.1 Describe the relationship between attitude and success in life and work.
2.5 Describe the "transfer of skill" as it relates to tentative occupational choices.	2.5.1 Describe the "transfer of skill" as it applies to tentative occupational goals.
2.6 Use decision-making processes in making occupational choices.	2.6.1 Choose an occupation in technical drawing and demonstrate how you use the decision-making process.

Skills/Subject Area: Technical Drawing and Planning

COMPETENCY GOAL 2: The learner will relate career information about technical drawing with human knowledge, skills, abilities, and attitudes.

Objectives		Measures	
2.7	Identify educational and financial requirements for achieving tentative career goals.	2.7.1	Identify education and financial requirements of tentative career goals.
2.8	List a cluster of occupations.	2.8.1	Name a cluster of occupations in technical drawing.
2.9	Identify desirable employee traits and work habits (e.g., dependability, cooperation, pride in work).	2.9.1	List the traits of a good employee.
2.10	List training opportunities at the high school, post-secondary, and college or university level.	2.10.1	Identify the type of jobs expected with: a. high school training b. post-secondary training c. college or university training

Grade Level: 10-12

Skills/Subject Area: Technical Drawing and Planning

COMPETENCY GOAL 3: The learner will demonstrate sketching as the simplest visual communication technique.

Objectives	Measures
3.1 Identify the basic sketching fundamentals: types, lines, symbols, arcs, circles, multiview, pictorial, dimensioning.	Refer to Competency/Test Item Book VEC-IAE-C/TIB 8161, pp. 8-11.
3.2 Demonstrate acceptable sketching techniques.	
3.3 Draw a sketch of a multiview drawing and a pictorial drawing.	

VOCATIONAL EDUCATION
INDUSTRIAL ARTS EDUCATION

Grade Level: 10-12

Skills/Subject Area: Technical Drawing and Planning

COMPETENCY GOAL 4: The learner will demonstrate the use of mechanical aids in producing accurate visual interpretations.

Objectives	Measures
4.1 Identify basic instruments used in drafting and indicate how each is used (pencils, scales).	Refer to Competency/Test Item Book VEC-IAE-C/TIB 8161, p. 13.
4.2 Use drafting instruments properly to draw lines, arcs, circles, and tangents.	

VOCATIONAL EDUCATION
INDUSTRIAL ARTS EDUCATION

Grade Level: 10-12

Skills/Subject Area: Technical Drawing and Planning

COMPETENCY GOAL 5: The learner will accurately construct geometric figures.

Objectives	Measures
5.1 Perform basic geometric construction techniques (e.g., drawing lines angles, squares, polygons, circles, tangents).	Refer to Competency/Test Item Book VEC-IAE-C/TIB 8161, pp. 14-16.
5.2 Perform advance geometric construction techniques correctly (e.g., drawing conic sections, ellipses, parabola, hyperbola, curves, and revolutions).	

VOCATIONAL EDUCATION
INDUSTRIAL ARTS EDUCATION

Grade Level: 10-12

Skills/Subject Area: Technical Drawing and Planning

COMPETENCY GOAL 6: The learner will describe and illustrate practical applications of precision drawings in the visual communications process.

Objectives	Measures
6.1 Describe the uses of multiview drawing.	Refer to Competency/Test Item Book, VEC-IAE-C/TIB 8161, pp. 17-48.
6.2 Identify the main views of multiview drawing.	
6.3 Draw multiview drawings using proper lines, symbols, dimensions, notes, and size and shape location.	
6.4 Identify dimensioning symbols used on drawings.	
6.5 Identify the basic rules for dimensioning.	
6.6 Describe size and shape description as it relates to dimensioning.	
6.7 Use proper dimensioning techniques on working drawing.	
6.8 Identify and define the three types of pictorial drawings (e.g., isometric, oblique, perspective).	

Grade Level: 10-12

Skills/Subject Area: Technical Drawing and Planning

COMPETENCY GOAL 6: The learner will describe and illustrate practical applications of precision drawings in the visual communications process.

Objectives	Measures
6.9 Draw pictoral drawing in isometric, oblique, and one point perspective.	
6.10 Describe the purpose of a sectional view (e.g., full, half, broken-out).	
6.11 Identify section lining symbols.	
6.12 Identify the basic techniques used in sectioning.	
6.13 Draw a full section view.	
6.14 Draw a half section view.	
6.15 Draw an offset section view.	
6.16 Describe the purpose of an auxiliary view.	
6.17 Define the relationship of an auxiliary view to regular views.	
6.18 Identify the three types of auxiliary views.	

Skills/Subject Area: Technical Drawing and Planning

COMPETENCY GOAL 6: The learner will describe and illustrate practical applications of precision drawings in the visual communications process.

Objectives	Measures
6.19 Identify the steps in constructing an auxiliary view.	
6.20 Draw auxiliary views properly.	
6.21 Describe the purpose of revolutions.	
6.22 Identify the rules for drawing revolutions.	
6.23 Demonstrate how to find the true length of a line through revolutions.	

VOCATIONAL EDUCATION
INDUSTRIAL ARTS EDUCATION

Grade Level: 10-12

Skills/Subject Area: Technical Drawing and Planning

COMPETENCY GOAL 7: The learner will describe and demonstrate practical applications of surface development.

Objectives	Measures
7.1 Describe the purpose of surface development.	Refer to Competency/Test Item Book VEC-IAE-C/TIB 8161, pp. 49-56.
7.2 Identify the two classes of development.	
7.3 Demonstrate parallel line development.	
7.4 Demonstrate development of cylinders.	
7.5 Draw a pattern for a two-piece elbow.	
7.6 Develop the pattern for a truncated circular cone.	
7.7 Demonstrate the intersection of a cylinder with cone.	

VOCATIONAL EDUCATION
INDUSTRIAL ARTS EDUCATION

Grade Level: 10-12

Skills/Subject Area: Technical Drawing and Planning

COMPETENCY GOAL 8: The learner will describe the following manufacturing processes.

Objectives	Measures
8.1 Define the following manufacturing processes: spot face, counter bore countersink, counter drill, ream, broach, chamfer, hone, grind.	Refer to Competency/Test Item Book VEC-IAE-C/TIB 8161, p. 57.
8.2 Cam and gear	pp. 58-64.
a. Define cam.	
b. Define gear.	
c. Describe the purpose of a cam.	
d. Layout and draw a cam.	
e. Describe the purpose of a gear.	
f. Identify the parts of a gear.	
g. Layout and draw several gear types.	
8.3 Fasteners and screws	pp. 65-72.
a. Identify several fastener types.	
b. Identify screw standards.	
c. Draw a detail representation of screw threads.	
d. Represent fasteners in schematic form.	
e. Draw acme screw threads.	
f. Draw square head and hexagon head bolts.	

Wood Technology Outline

1. Introduction to Wood Technology

2. Career Information About Wood Technology

3. Operational Procedures in Wood Technology Classroom/Laboratory

4. History of Wood as a Natural Resource in the Construction of Useful Products

   a. Wood as a natural resource
   b. Evolution of forest products and tools

5. Practical Application of Research and Design Concepts in Planning For Construction of a Product

   a. Furniture styles
   b. Components of design as related to wood construction
   c. Working drawings
   d. Selecting and activity project
   e. Procedures for a product

6. Physical and Chemical Characteristics of Woods in Product Construction

   a. Classification of trees
   b. Main parts of a tree
   c. Types of wood common to woodworking

7. Conversion of Wood from Raw Materials into a Useable Form for Construction

   a. Process of tree from forest to mill site
   b. Methods of processing logs into lumber

8. Useful Products Processed from Forest

9. Ensure Safe Working Environment within the Wood Technology Lab

10. Operation of Stationary Power Equipment used in Processing Wood into Usable Product

    a. Tablesaw
    b. Jointer
    c. Radial arm saw
    d. Bandsaw
    e. Jigsaw
    f. Shaper

g. Lathe
h. Router
i. Drill press
j. Mortise machine
k. Table belt sander
l. Vertical/Horizontal sander
m. Pneumatic sander
n. Disk sander
o. Spindle sander
p. Mitre box saw

VOCATIONAL EDUCATION
INDUSTRIAL ARTS EDUCATION

Grade Level: 10-12 Skills/Subject Area: Wood Technology

COMPETENCY GOAL 1: The learner will identify the purposes of the industrial arts program.

Objectives	Measures
1.1 Describe the major objectives of the instructional program.	1.1.1 What are the objectives of the industrial arts course called wood technology?

VOCATIONAL EDUCATION
INDUSTRIAL ARTS EDUCATION

Grade Level: 10-12 Skills/Subject Area: Wood Technology

COMPETENCY GOAL 2: The learner will relate career information about wood technology with human knowledge, skills, abilities, and attitudes.

Objectives		Measures	
2.1	Identify personal interests, physical characteristics, aptitudes, and mental abilities.	2.1.1	Identify your: a. personal interests b. physical characteristics c. aptitudes d. mental abilities
2.2	Identify possible career options consistent with abilities and aptitudes.	2.2.1	List three careers in wood technology that fit your aspirations and abilities.
2.3	Describe how value judgements affect lifestyles and career aspirations.	2.3.1	Explain how value judgements affect lifestyles and career aspirations.
2.4	Describe relationship between attitude and success in life and work.	2.4.1	Describe the relationship between attitude and success in life and work.
2.5	Describe the "transfer of skill" as it relates to tentative occupational choices.	2.5.1	Describe "transfer of skill" as it applies to tentative occupations career goals.
2.6	Use decision-making processes in making occupational choices.	2.6.1	Choose an occupation in wood technology and demonstrate how you use the decision-making process.
2.7	Identify educational and financial requirements for achieving tentative career goals.	2.7.1	Identify a tentative career goal and describe the educational and financial requirements.
2.8	List a cluster of occupations.	2.8.1	Name a cluster of occupations in wood technology.

Skills/Subject Area: Wood Technology

COMPETENCY GOAL 2: The learner will relate career information about wood technology with human knowledge, skills, abilities, and attitudes.

Objectives	Measures
2.9 Identify desirable employees.	2.9.1 List the traits of a good employee.
2.10 List training opportunities at the high school, post-secondary, and college or university level.	2.10.1 Identify the types of jobs one might expect as a result of: a. high school training b. post-secondary training c. college and university training

VOCATIONAL EDUCATION
INDUSTRIAL ARTS EDUCATION

Grade Level: 10-12 Skills/Subject Area: Wood Technology

COMPETENCY GOAL 3: The learner will know operational procedures in the wood technology classroom/laboratory.

Objectives	Measures
3.1 Describe the classroom procedure system used.	Refer to Competency/Test Item Book VEC-IAE-C/TIB 8101, pp. 18-19
a. Describe the goals for wood technology.	
b. Describe the expectations for the class.	
c. Describe the evaluation system used.	
d. Describe the student personnel organization used.	
e. Describe what the responsiibilities of the student are.	

VOCATIONAL EDUCATION
INDUSTRIAL ARTS EDUCATION

Grade Level: 10-12　　Skills/Subject Area: Wood Technology

COMPETENCY GOAL 4: The learner will describe wood as a natural resource and discuss its history in the construction of useful products.

Objectives	Measures
4.1 Describe the importance of wood as a natural resource. a. Identify products made from wood. b. Describe the economic importance of the wood industries. c. Describe the ecological importance of the forest. d. Describe the tree oxygen replacement cycle.	4.1.1 Refer to Competency/Test Item Book VEC-IAE-C/TIB 8181, pp. 20-21.
4.2 Evolution of forest products and tools. a. Describe early uses of forest products. b. Describe early hand tools used in woodworking. c. Describe early machine tools used in woodworking.	

VOCATIONAL EDUCATION
INDUSTRIAL ARTS EDUCATION

Grade Level: 10-12 Skills/Subject Area: Wood Technology

COMPETENCY GOAL 5: The learner will describe and demonstrate the practical application of research and design concepts in planning for construction of a product.

Objectives	Measures
5.1 Identify furniture styles. a. Identify leg styles. b. Identify chair styles. c. Describe a furniture period.	Refer to Competency/Test Item Book VEC-IAE-C/TIB 8181, pp. 22-31.
5.2 Describe the basic components of design as related to wood construction. a. Describe design principles. b. Describe color harmony.	
5.3 Read a working drawing. a. Identify the alphabet of lines used in a working drawing b. Make a working drawing.	
5.4 Identify the factors you should consider in selecting an activity project. a. Identify personal interest, and physical and mental abilities.	

Grade Level: 10-12

Skills/Subject Area: Wood Technology

COMPETENCY GOAL 5: The learner will describe and demonstrate the practical application of research and design concepts in planning for construction of a product.

Objectives	Measures
5.5 List the plan of procedures for a product.	
a. Make a bill of material for a project.	
b. Use basic math skills as applied to woodworking.	
c. Estimate the cost of a project.	
d. Make a full-size working drawing.	

VOCATIONAL EDUCATION
INDUSTRIAL ARTS EDUCATION

Grade Level: 10-12 Skills/Subject Area: Wood Technology

COMPETENCY GOAL 6: The learner will identify physical and chemical characteristics of woods in relation to appropriate application in product construction.

Objectives	Measures
6.1 Describe the classification of trees. a. Identify and describe American forest regions. b. Identify differences between hardwood and softwood. c. Identify, visually, hardwoods and softwoods.	Refer to Competency/Test Item Book VEC-IAE-C/TIB 8181, pp. 32-38.
6.2 Identify the main parts of a tree. a. Identify the total tree structure. b. Identify the parts of a cross section of a tree trunk.	
6.3 Describe the properties and characteristics of various types of wood common to woodworking.	

VOCATIONAL EDUCATION
INDUSTRIAL ARTS EDUCATION

Grade Level: 10-12 Skills/Subject Area: Wood Technology

COMPETENCY GOAL 7: The learner will describe the process for conversion of wood from a raw material into a usable form for construction.

Objectives	Measures
7.1 Describe the processing of trees from forest to mill site.	Refer to Competency/Test Item Book VEC-IAE-C/TIB 8181.
7.2 Describe methods of processing logs into lumber.	
a. Describe the methods of sawing lumber.	
b. Describe the system of grading hardwood and softwood lumber.	
c. Describe the methods of drying or seasoning lumber.	
d. Describe the common defects in lumber.	

VOCATIONAL EDUCATION
INDUSTRIAL ARTS EDUCATION

Grade Level: 10-12 Skills/Subject Area: Wood Technology

COMPETENCY GOAL 8: The learner will identify usable products processed from forests.

Objectives	Measures
8.1 Identify products produced from forests (e.g., hardboard, particle board veneer, plywood, paper).	Refer to Competency/Test Item Book VEC-IAE-C/TIB 8181, pp. 39-40
a. Describe the methods of cutting veneers.	
b. Identify the figure patterns of veneers.	
c. Describe the method of manufacturing plywood.	
d. Describe and identify the method of grading hardwood and softwood plywood.	
e. Describe the method of manufacturing hardwood.	
f. Identify the classifications of hardboard.	
g. Describe the method of manufacturing particle board.	
h. Describe the method of manufacturing paper.	
i. Identify products made from paper.	
j. Identify distillation products of the forest.	
k. Identify commercial products from wood hydrolysis plants.	

VOCATIONAL EDUCATION
INDUSTRIAL ARTS EDUCATION

Grade Level: 10-12 Skills/Subject Area: Wood Technology

COMPETENCY GOAL 9: The learner will identify personal practices necessary to ensure a safe work environment.

Objectives	Measures
9.1 Identify the general safety rules to be followed in woodworking. a. Describe method used to lift heavy objects. b. Describe placement of short pieces of lumber. c. Describe methods used to hold down objects. d. Describe why waste rags are placed in air tight containers. e. Describe acceptable dress. f. Describe expected common courtesy. g. Describe correct method of handling tools and materials. h. Describe the importance of forming safe work habits.	Refer to Competency/Test Item Book VEC-IAE-C/TIB 8181, p. 41.

VOCATIONAL EDUCATION
INDUSTRIAL ARTS EDUCATION

Grade Level: 10-12 Skills/Subject Area: Wood Technology

COMPETENCY GOAL 10: The learner will identify and demonstrate the correct use of stationary power equipment used in the processing wood into a usable product.

Objectives	Measures
10.1 Describe the operation of a table saw.	Refer to Competency/Test Item Book VEC-IAE-C/TIB 8181, pp. 42-77.
a. Identify and describe parts.	
b. Describe how machine is sized.	
c. Describe common cutting operations.	
c. Make a rip cut.	
d. Make a cross cut.	
e. Make a dado cut.	
f. Make a rabbet cut.	
g. Make a groove cut.	
h. Describe resawing.	
i. Describe methods of cutting duplicate parts.	
j. Make a bevel cross cut.	
k. Make a bevel rip cut.	
l. Make a mitre cut.	
m. Make a cove cut.	
n. Make a taper cut.	
o. Identify different saw blades.	

Grade Level: 10-12

Skills/Subject Area: Wood Technology

COMPETENCY GOAL 10: The learner will identify and demonstrate the correct use of stationary power equipment used in the processing wood into a usable product.

Objectives	Measures
p. Identify a molding cutter.	
q. Perform maintenance operations on table saw.	
r. Make a chamfer cut.	
s. Make normal operational adjustments.	
t. Describe cutting of raised panel.	
10.2 Describe use and operation of the jointer.	
a. Identify and describe parts.	
b. Describe how machine is sized.	
c. Describe common cutting operations.	
d. Joint a face.	
e. Joint an edge.	
f. Adjust jointer properly.	
g. Make a rabbet cut.	
h. Make a bevel cut.	
i. Make a chamfer cut.	
j. Make a stop chamfer cut.	

Skills/Subject Area: Wood Technology

COMPETENCY GOAL 10: The learner will identify and demonstrate the correct use of stationary power equipment used in the processing wood into a usable product.

Objectives	Measures
k. Make a taper cut.	
l. Make a spring joint.	
m. Joint end grain and plywood.	
10.3 Describe the use and operation of the planer.	
a. Identify and describe parts.	
b. Describe how machine is sized.	
c. Describe common cutting operations.	
d. Size wide stock to uniform thickness.	
e. Size square stock to uniform thickness and width.	
f. Make a bevel cut.	
g. Make a tapered cut.	
h. Make a bedboard cut.	
i. Make a normal operation adjustments.	

Grade Level: 10-12

Skills/Subject Area: Wood Technology

COMPETENCY GOAL 10: The learner will identify and demonstrate the correct use of stationary power equipment used in the processing wood into a usable product.

Objectives	Measures
10.4 Describe the operation of the radial arm saw.	
a. Identify and describe parts and types.	
b. Describe how machine is sized.	
c. Make normal operational adjustments.	
d. Describe common cutting operations.	
e. Make a rip cut.	
f. Make a cross cut.	
g. Make a dado cut.	
h. Make a rabbet cut.	
i. Make a plowing cut.	
j. Describe method of cutting duplicate parts.	
k. Make a bevel cross cut.	
l. Make a bevel rip cut.	
m. Make a mitre cut.	
n. Identify different saw blades.	
o. Describe routing methods.	
p. Describe sanding methods.	
q. Describe raised panel.	
r. Describe surfacing.	

Skills/Subject Area: Wood Technology

COMPETENCY GOAL 10: The learner will identify and demonstrate the correct use of stationary power equipment used in the processing wood into a usable product.

Objectives	Measures
10.5 Describe the operation of the band saw.	
a. Identify and describe parts.	
b. Describe how machine is sized.	
c. Make normal operational adjustments.	
d. Describe common cutting operations.	
e. Make a rip cut.	
f. Make a cross cut.	
h. Describe methods of cutting duplicate parts.	
i. Make a bevel cross cut.	
j. Make a bevel rip cut.	
k. Make a mitre cut.	
l. Identify different saw blades.	
m. Describe sanding methods.	
n. Describe relief cutting.	
o. Describe regular and irregular cutting.	

Skills/Subject Area: Wood Technology

COMPETENCY GOAL 10: The learner will identify and demonstrate the correct use of stationary power equipment used in the processing wood into a usable product.

Objectives	Measures
10.6 Describe the operation of the jigsaw. a. Identify and describe parts. b. Describe how machine is sized. c. Describe common cutting operations. d. Make normal operations adjustments. e. Describe internal and external operations. f. Describe making inlay designs and pictures. g. Describe use of jigsaw as a sabre saw. h. Describe sanding operations.	

Skills/Subject Area: Wood Technology

COMPETENCY GOAL 10: The learner will identify and demonstrate the correct use of stationary power equipment used in the processing wood into a usable product.

Objectives	Measures
10.7 Describe the operation of the shaper.	
a. Identify and describe parts.	
b. Describe how machine is sized.	
c. Describe common cutting operations.	
d. Make normal operation adjustments.	
e. Shape a straight edge.	
f. Shape an irregular and circular edge.	
g. Describe the shaping of an outline.	
h. Describe reeding and fluting.	
i. Describe cutting a raised panel.	
j. Describe cutting a reverse glue joint.	
k. Shape a reverse glue joint.	

COMPETENCY GOAL 10: The learner will identify and demonstrate the correct use of stationary power equipment used in the processing wood into a usable product.

Objectives	Measures
10.8 Describe the operation of the lathe.	
a. Identify and describe parts.	
b. Describe how machine is sized.	
c. Describe common cutting operations.	
d. Make normal operational adjustments.	
e. Make a spindle turning using basic cuts.	
f. Make face plate turning using basic cuts.	
g. Describe special chunk turning.	
h. Describe mandrel turning.	
10.9 Describe the operation of the router.	
a. Identify and describe parts.	
b. Describe how machine is sized.	
c. Describe common cutting operations.	
d. Make normal operational adjustments.	
e. Shape exterior and interior edges.	
f. Describe profiling operation.	
g. Compare portable and overhead routing application.	

Grade Level: 10-12

Skills/Subject Area: Wood Technology

COMPETENCY GOAL 10: The learner will identify and demonstrate the correct use of stationary power equipment used in the processing wood into a usable product.

Objectives	Measures
10.10 Describe the operation of the drill press.	
a. Identify and describe parts.	
b. Describe how machine is sized.	
c. Describe common cutting operation.	
d. Make normal operation adjustments.	
e. Describe boring and cutting operations.	
f. Cut a dowel and circular plug.	
g. Describe routing, inlaying, and shaping.	
h. Describe pattern routing.	
i. Describe shaping operation.	
j. Describe sanding operation.	
i. Make a mortise using mortising attachment with hollow chisel.	
l. Describe circle cutting.	

Skills/Subject Area: Wood Technology

COMPETENCY GOAL 10: The learner will identify and demonstrate the correct use of stationary power equipment used in the processing wood into a usable product.

Objectives	Measures
10.11 Describe the operation of the mortise machine.	
a. Identify and describe parts.	
b. Describe how machine is sized.	
c. Describe common cutting operations.	
d. Make normal adjustments.	
f. Use methods of cutting narrow and wide mortises (chain and hollow chisel).	
10.12 Describe the operation of a table belt sander.	
a. Identify and describe parts.	
b. Describe how machine is sized.	
c. Describe common sanding operations.	
d. Make normal operational adjustments.	
e. Sand a flat surface.	

Skills/Subject Area: Wood Technology

COMPETENCY GOAL 10: The learner will identify and demonstrate the correct use of stationary power equipment used in the processing wood into a usable product.

Objectives	Measures
10.13 Describe the operation of a vertical/horizontal sander. a. Identify and describe parts. b. Describe how machine is sized. c. Describe common sanding operations. d. Make normal operational adjustments. e. Sand a small flat surface. f. Sand a bevel edge and end. g. Sand a concave edge and end.	
10.14 Describe the operation of a pneumatic sander. a. Identify and describe parts. b. Describe how machine is sized. c. Describe common sanding operation. d. Make normal operational adjustments. e. Sand an edge and surface.	

Skills/Subject Area: Wood Technology

COMPETENCY GOAL 10: The learner will identify and demonstrate the correct use of stationary power equipment used in the processing wood into a usable product.

Objectives	Measures
10.15 Describe operation of a disk sander.	
a. Identify and describe parts.	
b. Describe how machine is sized.	
c. Describe common sanding operations.	
d. Make normal operational adjustments.	
e. Sand an end.	
f. Sand a convex edge.	
10.16 Describe operation of spindle sander.	
a. Identify and describe parts.	
b. Describe how machine is sized.	
c. Describe common sanding operations.	
d. Make normal operational adjustments.	
e. Sand a curved edge.	

Skills/Subject Area: Wood Technology

COMPETENCY GOAL 10: The learner will identify and demonstrate the correct use of stationary power equipment used in the processing wood into a usable product.

Objectives	Measures
10.17 Describe the operation of mitrebox saw.	
a. Identify and describe parts.	
b. Describe how machine is sized.	
c. Describe common sawing operations (90° - 45°).	
d. Make normal operating adjustments.	
e. Cut a mitre for any angle.	

APPENDICES

APPENDIX A

House Bill 1567*

A BILL TO BE ENTITLED AN ACT TO ENACT THE ELEMENTARY AND SECONDARY SCHOOL REFORM ACT OF 1984.

The General Assembly of North Carolina enacts:

Section 1. This act may be referred to as the "Elementary and Secondary School Reform Act of 1984."

Section 2. G.S. 115C-81(a) is amended by deleting the first paragraph and substituting the following:

"Standard Course of Study. It is the policy of the State of North Carolina to insure a quality education to every child residing in North Carolina. To this end, the General Assembly directs the State Board of Education to develop a standard course of study to be offered to every child in North Carolina public schools and to submit the proposed standard course of study to the General Assembly by October 15, 1984.

The standard course of study shall reflect a rigorous academic course of study stressing mastery of integrated knowledge based on mastery of competencies in the basic skill areas rather than the study of isolated disciplines. To this end, the State Board of Education is directed to undertake a statewide audit of current curricula and to refine the curricula as required to comply with this policy. The standard course of study:

1. shall stress mastery of integrated knowledge;

2. should provide students with the specific competencies needed to gain employment or to continue their education;

3. should provide students with the skills necessary to cope with contemporary society;

4. shall contain a vocational education component designed to meet the State's and local anticipated career training needs;

5. shall provide for a program of continuous learning based upon the individual child's need, interest, and stages of development, so that the program has a nongraded structure of organization;

6. shall set forth what subjects shall be taught in each grade, and outline the basal and supplementary books on each subject to be used in each grade;

7. shall include a core curriculum for all students plus additional elective curriculum choices to meet the varied needs and interests of students;

8. shall establish a minimum length of the instructional day;

9. shall prescribe standards for student performance and promotion and may consider appropriate levels at which remediation should begin; and

10. shall describe appropriate class size for each course required by the standard course of study; staffing levels to support the standard course of study, and may include minimum staffing for schools, regardless of size, where such schools are determined to be essential to serve pupils located in isolated geographic areas; minimum facility requirements for the standard course of study; minimum material requirements for the standard course of study; and such other information the Board finds necessary to enable the General Assembly to allocate appropriate resources to implement the plan."

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*Includes only that portion of HB 1567 addressed by the Basic Education Program for North Carolina's Public Schools, the North Carolina Standard Course of Study, and the North Carolina Competency-Based Curriculum.

APPENDIX B

16 NCAC 2E.0103; STANDARD COURSE OF STUDY: POLICIES

(a) Definitions. As used in this Rule:

(1) "Standard Course of Study" means the program of course work for each of the various subjects taught in the elementary and secondary schools of the state, together with competency goals and performance indicators, as defined in (4) and (5) of this subsection, which have been adopted by the state board pursuant to G. S. 115C-81 (a) and subsection (b) of this Rule.

(2) "Curriculum guide" means a document prepared by the State Department of Public Instruction for each subject or area of study listed in the Standard Course of Study, including suggestions as to suitable instructional aids, textbooks and supplementary resources, learning experiences and teaching methods.

(3) "Course unit" means a minimum of 150 clock hours of instruction. Short courses will be credited in an amount corresponding to the fractional part of a total unit.

(4) "Competency goals" means the ends toward which student learning is directed.

(5) "Performance indicators" means quantitative measures of progress toward competency goals.

(b) The state board shall adopt and periodically review the Standard Course of Study, upon recommendation of the State Superintendent and pursuant to a public hearing and any changes the board deems appropriate. The Standard Course of Study shall be published by the state board. Copies of the Standard Course of Study and the curriculum guides may be obtained from the Department of Public Instruction, 116 W. Edenton Street, Raleigh, N. C. 27611.

(c) The Standard Course of Study shall include, at a minimum, a kindergarten through 12th grade program of studies in the following areas:

(1) citizenship, including the social studies-economics, history, government, sociology and human relations;

(2) communications, including foreign languages, educational media, and all phases and applications of English-language arts;

(3) cultural arts, including the fine and performing arts, recreation and avocations, addressed to both performance and consumer objectives;

(4) healthful living, including personal and community health, physical education, recreation, and safety;

(5) mathematics, including computational, problem solving, and consumer skills and substantive advanced elective sequences;

(6) science, including the basic study of all living and nonliving things as well as advanced elective sequences; and

(7) vocational, including a developmental design, moving from occupational exploration in the middle grades, to selective specialization in the senior high school, as set out in the state Master Plan for vocational education.

(d) The development of subject and course content in the study areas listed in (c) of this Rule shall include, as appropriate for the various grade levels, the study of Americanism, the government of the State of North Carolina, the government of the United States, fire prevention, harmful or illegal drugs including tobacco and alcohol, and the free enterprise system.

(e) The Standard Course of Study shall be implemented in the kindergarten through eighth grades through an appropriate developmental program in each study area for individual pupils. Summer school for these grades is considered an integral part of the regular school term. The Standard Course of Study shall be implemented in the 9th through 12th grades through a program of representative course offerings in each study area.

(f) Graduation Requirements

(1) In addition to the requirements of 16 NCAC 2G.0702, students graduating during or after the 1986-87 school year must successfully complete 20 courses units in grades 9 through 12 to be graduated from high school. These course units must include the following:

- (A) four course units in English;
- (B) two course units in mathematics;
- (C) two course units in social studies; one unit in government and economics, and one unit in United States history;
- (D) two course units in science, one unit in a life science or biology, and one unit in one of the physical sciences;
- (E) one course unit in physical education and health;
- (F) nine course units to be determined by the local education agency. These may be undesignated electives or designated from the study areas described in subsection (c) of this Rule.

(2) Course work successfully completed in the ninth grade at a school system where course units are not awarded in the ninth grade shall be deemed to satisfy the requirements of (1) of this subsection.

(3) Course work successfully completed by students in grades 9 through 12 at a summer school session may be used to satisfy the requirements of (1) of this subsection. Course units so taken shall be earned in the same manner as otherwise provided in this Rule, except that for students repeating courses in summer school the principal shall determine the hours of instruction required to be repeated.

(4) Course work successfully completed by students in grades 9 through 12 at an off-campus institution may be used to satisfy the requirements of (1) of this subsection. No high school may approve enrollment in post-secondary institutions during the regular school year in excess of five percent of its enrollment in grades 10-12 except as approved by the State Board of Education. Enrollment under this policy in community college institutions shall be in accordance with 16 NCAC 2E.0301.

History Note: Statutory Authority G. S. 115C-12(9)c; G. S. 115C-81(a);
Eff. February 1, 1976
Readopted Eff. February 3, 1978;
Amended Eff. April 1, 1983; June 8, 1979

APPENDIX C

COURSE REQUIREMENTS FOR HIGH SCHOOL GRADUATION

Course Units	Subjects
4	English
2	Mathematics
2	Social studies (1 unit in government and economics, 1 unit in United States History)
2	Science (1 unit in a life science or biology, 1 unit in one of the physical sciences)
1	Physical education and health
9	Determined by the local education agency (these may be undesignated electives or designated in the study areas of citizenship, communications, the arts, healthful living, mathematics, science, vocational education)
20 Total Course Units	

APPENDIX D

NORTH CAROLINA STATE BOARD OF EDUCATION
NORTH CAROLINA SCHOLARS' PROGRAM

PLAN A

The North Carolina State Board of Education, believing that the success of our State and Nation depends on the full development of our youth and that some students should be encouraged to pursue a well-balanced but more vigorous high school program, institutes a North Carolina Scholars' Program.

Beginning with the 1983-84 school year, students satisfactorily completing requirements as identified by the State Board shall be named North Carolina Scholars and receive special recognition by the State Board.

Course Requirements

Program Area	Units
English	4
Mathematics - Algebra I, Geometry, Algebra II, one beyond Algebra II	4
Science - Biology, Chemistry, Physics (or in lieu of Physics, one other advanced science)	3
Social Studies - U. S. History, Government/Economics, World Cultures (Prior to 1987, U. S. History plus two elective units)	3
Foreign Languages - two levels of the same language	2
Health, P. E.	1
Vocational Education	1
Arts Education	1
Electives - minimum of three	3
	22

Additional Requirement

Students must have an overall four year grade average of B or its equivalent as determined by the local board of education. Equivalency may be determined by numerical grades or weighted grade point averages.

Recognition

1. Students meeting all requirements for a North Carolina Scholars' Program receive from the State Board of Education an appropriate seal of recognition to be affixed to the diploma.

2. Special recognition events should be held in the school and community to honor the students and their parents. These should include appropriate, special recognition at graduation exercises.

3. The State of North Carolina as well as business and industry should consider awarding other special recognitions to these students.

4. Colleges and universities should consider the North Carolina Scholars' achievement when making decisions concerning acceptance by their institutions.

5. An identification of potential candidates for this achievement should be made at the end of grade 11. Candidates would include those students who, after completing their selected senior courses with the designated grade average, would be eligible for recognition. This identification of candidates would reinforce the students' efforts to achieve the recognition and could also be included on their application forms and/or transcripts to colleges and universities.

NORTH CAROLINA STATE BOARD OF EDUCATION
NORTH CAROLINA SCHOLARS' PROGRAM

PLAN B

The North Carolina State Board of Education, believing that the success of our State and Nation depends on the full development of our youth and that some students should be encouraged the pursue a well-balanced but more vigorous high school program, institutes a North Carolina Scholars' Program with concentration in one or more program areas. In order to allow more flexibility in the program, consideration should be given to the optional sequence of courses listed below as an alternative to Plan A.

Beginning with the 1983-84 school year, students satisfactorily completing requirements as identified by the State Board shall be named North Carolina Scholars and receive special recognition by the State Board.

Course Requirements

Program Area	Units
English	4
Mathematics - Algebra I, Geometry, Algebra II	3
Science - Biology, Chemistry, Physics (or in lieu of Physics, one other advanced science)	3
Social Studies - U. S. History, Government/Economics, one additional social studies (Prior to 1987, U. S. History plus two elective units)	3
Foreign Languages - two levels of the same language	2
Health, P. E.	1
Vocational Education	1
Arts Education	1
Electives - minimum of four (concentrations may be selected as listed below)	4
	22

Concentrations

Mathematics - at least one additional advanced unit (balance - 3 electives)

Science - at least one additional advanced unit (balance - 3 electives)

Social Studies - at least one additional unit (balance - 3 electives)

Foreign Languages - at least two additional units of the same language (balance - 2 electives)

Health, P. E. - at least three additional units (balance - 1 elective)

Arts Education - as least three additional units (balance - 1 elective)

Vocational Education - at least three additional units (balance - 1 elective) Three of the minimum four units required for concentration in vocational education must be related to the same vocational objective. Additional units may be related to the same vocational objective or may be in other vocational areas.

Additional Requirement

Students must have an overall four year grade average of B or its equivalent as determined by the local board of education. Equivalency may be determined by numerical grades or weighted grade point averages.

Recognition

1. Students meeting all requirements for a North Carolina Scholars' Program will receive from the State Board of Education an appropriate seal of recognition to be affixed to the diploma.

2. Special recognition events should be held in the school and community to honor the students and their parents. These should include appropriate, special recognition at graduation exercises.

3. The State of North Carolina as well as business and industry should consider awarding other special recognitions to these students.

4. Colleges and universities should consider the North Carolina Scholars' achievement when making decisions concerning acceptance by their institutions.

5. An identification of potential candidates for this achievement should be made at the end of grade 11. Candidates would include those students who, after completing their selected senior courses with the designated grade average, would be eligible for recognition. This identification of candidates would reinforce the students' efforts to achieve the recognition and could also be included on their application forms and/or transcripts to colleges and universities.

APPENDIX E

NORTH CAROLINA COMPETENCY-BASED CURRICULUM

Sample Page

Grade Level: 6 Skills/Subject Area: Social Studies/Knowledge

Competency Goal: 1. The learner will know that ways of living change over time and how and why these changes occur (history).

OBJECTIVES	MEASURES
1.1 Identify changes which have occurred in Europe and/or the Soviet Union.	1.1.1 List changes which have occurred when given an appropriate series of photographs depicting changes in ways of living (dress, housing, work, transportation, and entertainment) in Europe and/or the Soviet Union.
	1.1.2 Draw a picture depicting what s/he believes to be the most significant change to have taken place in Europe or the Soviet Union; describe the picture and explain her/his reasoning aloud to the rest of the class.
1.2 Identify the effect of important changes which have occurred in Europe or the Soviet Union.	1.2.1 Place the examples in chronological order when given appropriately chosen examples of change in Europe or the Soviet Union.
	1.2.2 Match the changes to the resulting effects and identify the country in which each change/effect occurred when given a list of changes and a list of effects.

APPENDIX F

TESTING REQUIREMENTS

Annual Testing Program

The Annual Testing Program consists of standardized tests in reading, language arts, and mathematics administered at grades 1, 2, 3, 6, and 9.* Beginning with science and social studies tests, other skills and subject areas may be added to this program in the future.

Promotion Testing

Phase 1: A student in grades 3, 6, or 8 who scores at or above the 25th percentile (total battery) in the Annual Testing Program meets the State standard for promotion and must them meet local requirements. A student who scores at the 24th percentile or below enters phase two.**

Phase 2: In phase two, a student is tested for mastery of competencies on a test developed by the State Board of Education. Students who demonstrate mastery meet State requirements and then must meet local requirements. Students who do not demonstrate mastery must be retained or attend a State-supported summer remediation program. Students attending the summer program will be assessed to determine whether they have mastered the minimum standards. Those who demonstrate mastery will have met State standards and may be promoted if they have also met local requirements. Those who have not demonstrated mastery will be retained.

End of Course Testing

End of Course Testing is conducted at the secondary level in Algebra I and biology. It is anticipated that up to 20 other courses may be added to this program by the year 1990.

Minimum Competency Testing

Students in grade 11*** are tested for mastery of minimum competencies in the areas of reading and mathematics. In order to graduate from high school, students must receive a passing score on all areas of the Minimum Competency Test.

* It is anticipated that testing will be moved from grade 9 to grade 8.

** The State standard will not apply to students already retained in the same grade span or certified as trainable mentally handicapped, educable mentally handicapped, or severely/profoundly mentally handicapped. Students otherwise handicapped may also be exempted according to standards and procedures developed by the State Board of Education.

*** It is anticipated that testing will be moved from grade 11 to grade 10.

APPENDIX G

TEXTBOOK ADOPTION PROCESS IN NORTH CAROLINA*

The first step in the adoption of basic textbooks is the appointment of a Textbook Commission as set forth in G.S. 115C-87. The law provides that the Textbook Commission shall be composed of fourteen members to be appointed by the Governor upon the recommendation of the State Superintendent of Public Instruction. The law further prescribes that seven of the members shall be outstanding teachers or principals in the elementary school grades, that five shall be outstanding teachers or principals in the high school grades, and that two shall be lay members, one of which shall be the parent of an elementary school student, and one of which shall be the parent of a high school student, with the added proviso that one of the members may be a county or city superintendent.

The State Board of Education authorizes textbook adoptions as set forth in G.S. 115C-85 and 86. The State Superintendent notifies members of the Textbook Commission that there is to be an adoption in a given subject area or areas. The State Superintendent also notifies all registered textbook publishers of the adoption call and invites them to submit any materials they would like to have considered.

Members of the Textbook Commission evaluate all textbooks offered for adoption.

All books submitted are viewed and evaluated within a frame of reference determined by the State course of study. Pursuant to a call and prior to reviewing materials, members of the Textbook Commission and the professional staff of the Department of Public Instruction engage in a thorough overview of the program of studies and develop a concise statement of philosophy, goals, and objectives for the course or subject area under consideration. This statement also reflects any changes or innovations in the program and takes into account current trends and emphases stemming from sound, authoritative research, and experimentation.

In the review and evaluation process each Commission member secures the help of as many advisers as he or she may choose. The number will vary but the usual practice has been for each member to select eight to twelve such advisers. Special expertise in the subject area under consideration is the main criterion in choosing advisers. Each Commission member tries to secure a representative group including classroom teachers, college personnel, supervisory and administrative personnel, and possibly laymen and students.

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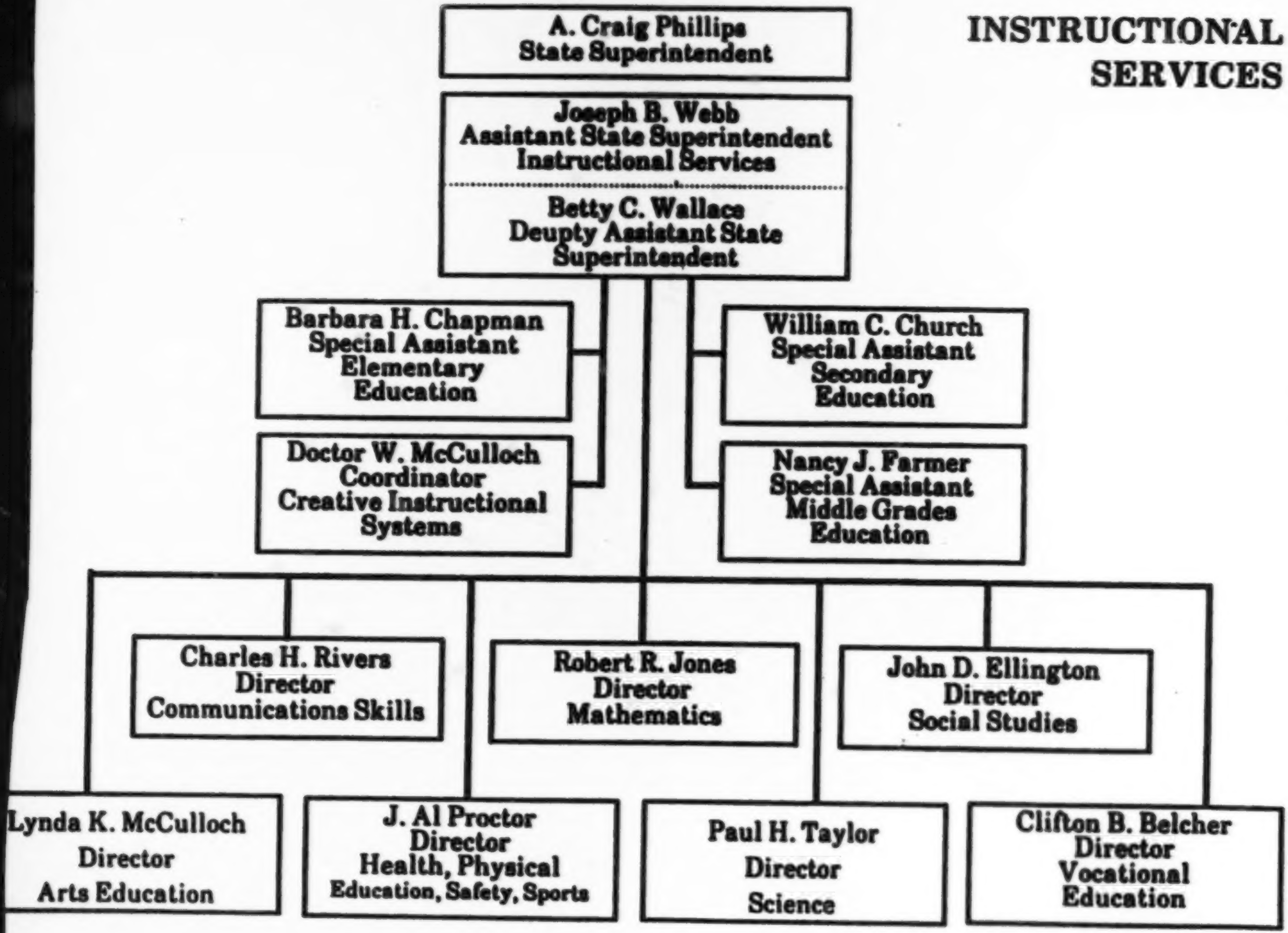
*From North Carolina State Adopted Basic Textbooks 1984-85. Raleigh, NC: Division of Textbooks, Controller's Office, Department of Public Education, 1984.

When the review process is completed, each Commission member files a written evaluation of every book submitted. These evaluation reports must be signed by the member making the report and the Commission Chairman delivers them to the State Superintendent who is also Secretary to the State Board of Education. At the next meeting of the Board of Education, after evaluation reports are filed, the members of the Textbook Commission meet with the Board for joint review and consideration of the reports. In the evaluation of basic textbooks the members of the Commission do not concern themselves in any way with the price of the book or its physical features.

Following the joint session of the Textbook Commission and the State Board to consider the findings and recommendations of the Commission, the State Board officially calls for sealed bids on those books which the Textbook Commission found to be most appropriate for implementing the desired program of instruction in North Carolina schools. Bids are customarily received on five to eight books. At the next meeting or at another designated regular meeting of the Board, the bids are opened and contracts awarded. Where significant differences in the appropriateness of books were noted by the Textbook Commission, the State Board traditionally has placed priority on securing the best materials available.

INSTRUCTIONAL SERVICES


A. Craig Phillips
State Superintendent
Joseph B. Webb
Assistant State Superintendent
Instructional Services
Betty C. Wallace
Deupty Assistant State Superintendent
Barbara H. Chapman
Special Assistant
Elementary Education
Doctor W. McCulloch
Coordinator
Creative Instructional Systems
William C. Church
Special Assistant
Secondary Education
Nancy J. Farmer
Special Assistant
Middle Grades Education
Charles H. Rivers
Director
Communications Skills
Robert R. Jones
Director
Mathematics
John D. Ellington
Director
Social Studies
Lynda K. McCulloch
Director
Arts Education
J. Al Proctor
Director
Health, Physical Education, Safety, Sports
Paul H. Taylor
Director
Science
Clifton B. Belcher
Director
Vocational Education

APPENDIX H

APPENDIX I

Suggestions for Additions to or Revisions of the

North Carolina Competency-Based Curriculum

1. Suggestion for: A. addition / / B. revision / / (please check one)
2. Skills/Subject Area: ______________________________
   (e.g., Mathematics, Social Studies, Science)
3. Page Number: ______
4. Addition/Revision to: (please check & give number)

Introduction	/ /	
Competency Goal	/ /	Number: ______
Objective	/ /	Number: ______
Measure	/ /	Number: ______

5. SUGGESTION: ______________________________

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6. Name of person submitting suggestion: ______________________
   Place of employment: ______________________
   Employed as: ______________________
   Address: ______________________

Please return this form to: Joseph B. Webb
Assistant State Superintendent
for Instructional Services
Education Building, Raleigh, NC 27611